

The Mining Journal

Established 1835

Railway & Commercial Gazette

Vol. CCXLVI No. 6286

LONDON, FEBRUARY 10, 1956

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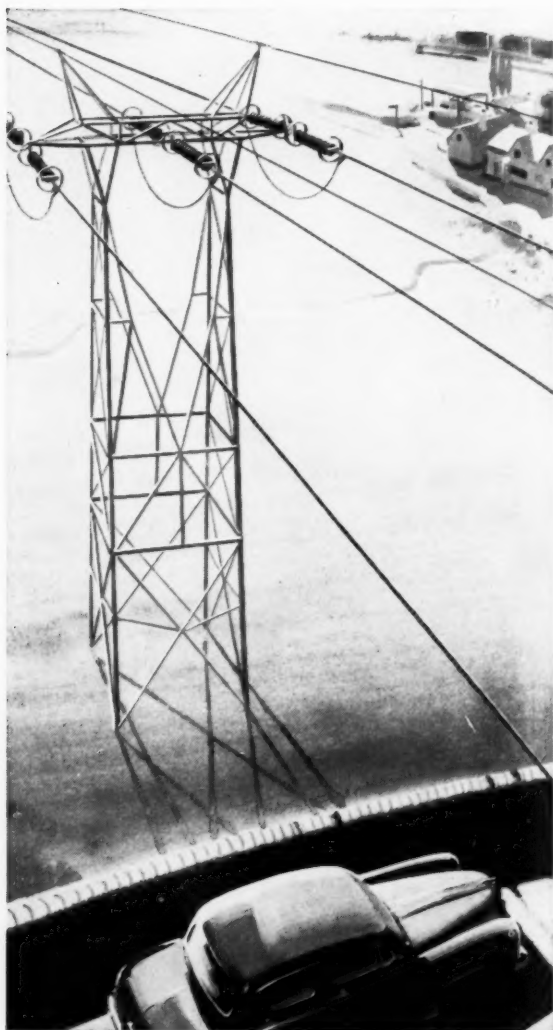


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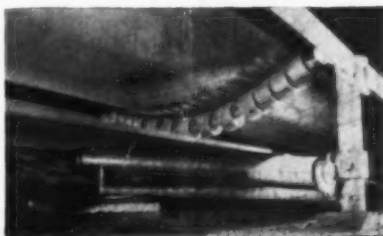
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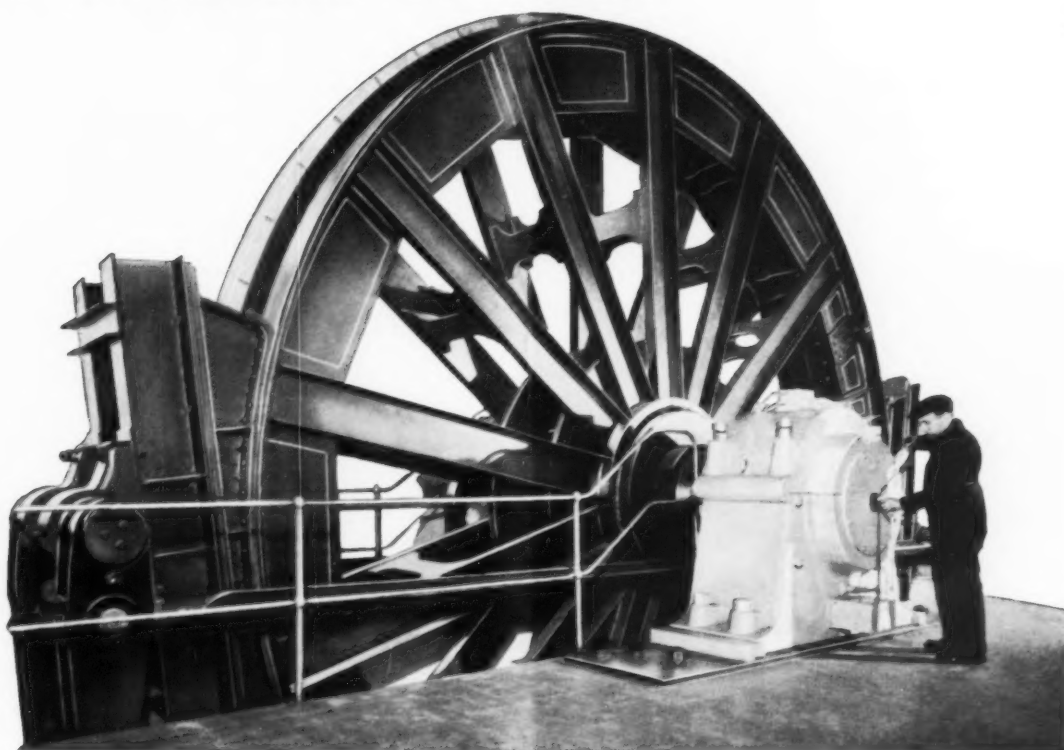
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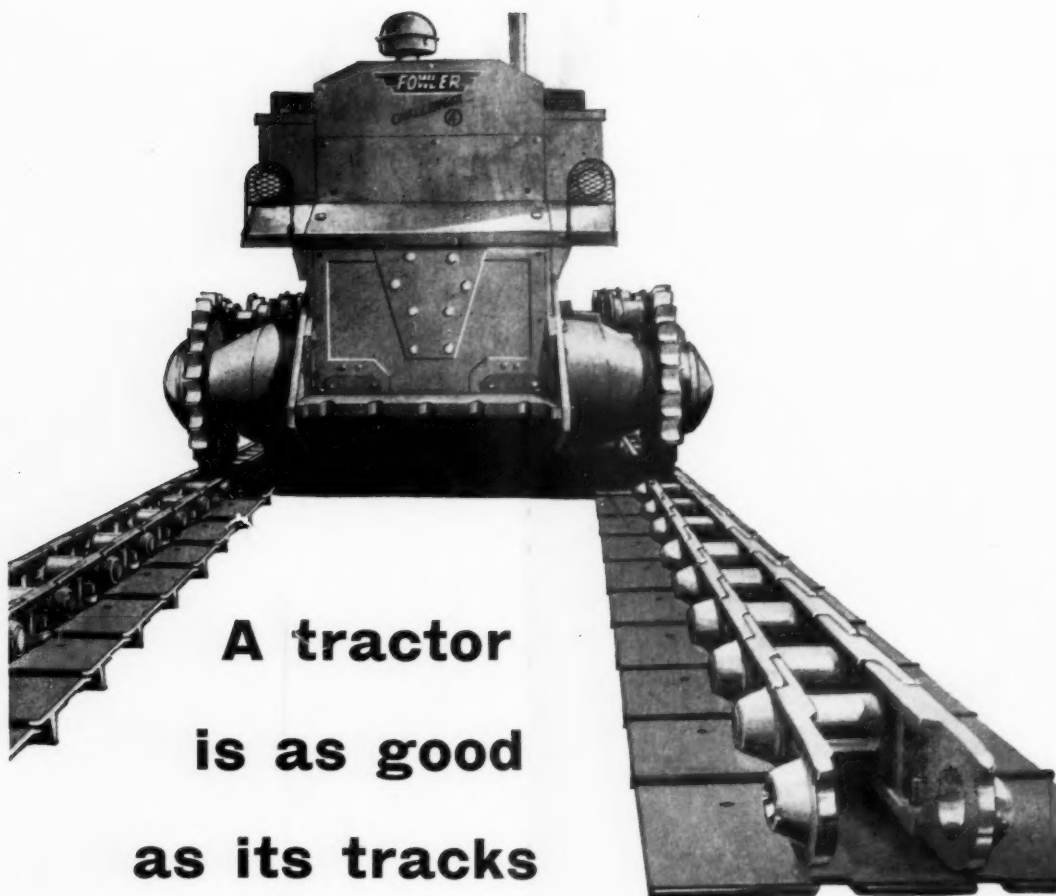
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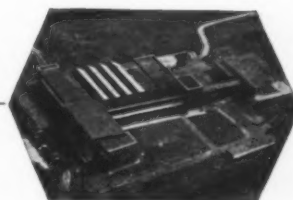
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NOTES AND COMMENTS

Shortage of Mining Engineers in Australia

A matter of increasing concern to the mining and metallurgical industry of Australia is the shortage of trained men. Teaching facilities in well-equipped and staffed mining schools are of a high order in the Australian universities, supplemented by the New South Wales University of Technology, additional to the University of Sydney, and by Schools of Mines and Technical Colleges. There is no lack of facilities for instruction, but the intake of students to the teaching centres is well below the demand for the graduates.

The fundamental reason for this state of affairs seems to be that the profession of mining engineering is less attractive than other branches of the engineering profession. The interest of the profession is unquestioned; the comforts and conveniences provided in the mining towns, and even on the small isolated mines are invariably good, or of a high order, and in no way inferior to what the cities provide, though there may be some disability in certain climates. At one time the nature of the life, leading often into little known country, was an attraction; now, this is far less potent. The attractive future to the senior school boy and to the student of engineering seems to lie in the city-based metallurgical, mechanical and electrical engineering industries, perhaps because of their wider social and sporting opportunities. The question of salaries and cost of living between mining towns and cities gives no valid reason for discrimination.

It is felt that an important factor in the neglect of the mining engineering profession lies in ignorance of what this life and profession really mean; it is not featured and is not advertised, whereas the normal industries in the cities are within the daily observation of most boys and so have their gradual influence. A committee of the Australasian Institute of Mining and Metallurgy is working on the problem, and to popularize the profession is instituting talks at schools and the showing of films, to which end film circuits, exhibiting films showing phases of mining and metallurgical operations, and mining life, have been established. The seed is being sown, but the growth must be gradual. It is a vital matter concerning the future of all mining companies and calls for their support. This

is already forthcoming, and annual Careers Exhibitions have been established and have attracted popular attention. A number of companies award scholarships and bursaries for mining courses, but this laudable course may be stultified by basic ignorance regarding the profession. To minimize this, the showing of short films on the mining industry in the commercial picture theatres would have value.

One Australian company, The Broken Hill Proprietary Company, has an excellent staff training scheme for the education, not only of tradesmen and accountancy students, but also in mechanical and electrical engineering, and in the mining side itself. Many of its trainees have risen to high executive positions. There are other factors, too, which show either a lack of interest in the profession, or else a lack of ambition. Some graduates, setting out into the practical world, are attracted much more by the money they are likely to get from certain companies rather than by the experience they are likely to get on other mines. Industrial awards can also be detrimental, and here, again, money without much responsibility, and the avoidance of apprenticeships before the high money can be reached, can be a check on ambition.

Under all State mining laws, mine managers' certificates must be obtained by examination. In coal mining, there are three grades. In Victoria it is very noticeable that whereas a fair number of men—with the advantage of a local technical school—sit for a third class, or deputies' certificate, it is very rare that a promising candidate, urged to continue at the technical school, will continue study for a second class certificate, or ultimately a first class. This attitude is fostered to some extent by industrial laws, for a man can earn more money at the coal face than as a deputy, and that is the overriding consideration. There is a compulsory retiring age for mine employees; there is looming in Victoria a serious shortage of deputies for the reason given. Many retired men could well fill deputies' positions but are not permitted under the industrial laws. The position throughout all ranks and grades is becoming increasingly serious and the immediate future will show the measure of success that may attend the efforts toward recruitment for the industry and the profession.

Europe's Non-Ferrous Metal Consumption

Total apparent consumption of non-ferrous metals increased by about 25 per cent in Europe in 1954 as compared with 1953 and by about 15 per cent in the first half of 1955 in comparison with the corresponding period of 1954. These statistics have been revealed in a report drafted by the Non-Ferrous Metals Committee of the Organization for European Economic Co-operation. The report deals with the trend of the situation in the non-ferrous metal industry in Europe.

The O.E.E.C. report finds that, during the period under review, the development of the non-ferrous metal industry in Europe has been influenced by two main factors: namely, the high level of activity in the industries using non-ferrous metals—chiefly mechanical and electrical engineering and building—in Europe itself, and the economic recovery in the United States.

The demand for non-ferrous metals in Europe has risen considerably. Indeed, the rise in 1954 over 1953 was (in percentage) copper 35, aluminium 25, zinc 24, lead 17, tin 9, and nickel 8. In the first half of 1955, the percentage, compared with the corresponding period of 1954, of apparent consumption was lower for lead (13), copper and zinc (12), but distinctly higher for aluminium (35). Production in European foundries also rose in 1954 as compared with 1953 and in the first half of 1955 as compared with the corresponding period of 1954. The increases were eight and five per cent respectively for aluminium, nine and seven for copper, three and zero for lead, 19 and four for zinc, six and three for tin, nine and 13 for nickel.

Difficulties of supply for aluminium, copper and nickel were experienced, changes in the level of supply and demand affecting the prices of the various metals differently. Aluminium and nickel prices remained fairly steady as producers remained faithful to their policy of price stability, copper prices reacted strongly to the shortage, itself the result of strikes rather than of any increase in demand. The price increase was much less pronounced for lead, zinc and tin. Although the copper market is unpredictable, it seems that the production increases forecast for 1956 should make it possible to restore the balance.

Although aluminium supply difficulties may be relieved in the long term by a broad investment policy, yet in view of the present rate of activity, there is no doubt that they will persist during the immediate future. Demand for lead and zinc increased considerably, in the period reviewed, but supplies were satisfactory and prices passed through a period of comparative stability.

The statistical position of tin was strengthened in 1955. It should, therefore, be less difficult for the International Agreement to fulfil its object than was the case a year ago, and this strengthening might prevent the appearance on the market of quantities of tin made available by the expiration of United States purchasing contracts.

Nickel production is expected to increase further in 1956, though to a lesser degree than in 1955 and 1954. In view of the stockpiling and defence requirements of the United States, however, the quantities available for civilian needs will differ little in 1956 from what they were in 1955.

Printing Dispute Alters "M.J." Contents

The printing dispute, now in its fourth week, has led to a change in content and a reduction in size of *The Mining Journal*, as announced in last week's issue. Our regular feature, Mining Markets, has been omitted and the London Metal Exchange prices given for copper, lead, tin, zinc are those ruling at the close of trading on Wednesday rather than on Thursday. *The Mining Journal* is not a party to the dispute.

Australia

(From Our Own Correspondent)

Melbourne, February 1.

Important expansion is forecast in the rutile mining industry. Australian beaches along the east coast, extending for a distance of some 400 miles in northern New South Wales and southern Queensland, a south-westerly section of the Western Australian coast, and coastal areas in King Island, Bass Strait, contain extensive occurrences of rutile, zircon, ilmenite and some monazite, and constitute one of the most important of the world's reserves of these minerals. These areas are now being actively explored for commercial concentrations of the heavy minerals.

The demand for rutile has attracted new companies into the field, in addition to the dozen or so engaged at the beginning of 1955. The newcomers are at present engaged in prospecting and exploration and some production from them may be expected during 1956. At current prices rutile is highly profitable and output is sold under forward contract for a considerable time ahead. Small parcels that may be available are selling at up to £120 per ton. Zircon, which is present in the beach sands in approximately equal proportion to rutile, and which must be separated from the mixed primary concentrate, is at present unprofitable, the selling price being about 50 per cent below cost of production; monazite forms a small by-product which can be recovered profitably, and is recovered either from current concentration, or later in retreatment. Ilmenite from the east coast beaches, is unsaleable because of chromium content, but the Western Australian concentrate is free from that contaminant mineral and is expected to be marketable.

It is anticipated that output of rutile in 1956 may approximate 55,000 tons; zircon may reach 50,000 tons.

LITTLE EXPANSION IN MINERAL EXPLORATION

The close of 1955 has shown no discoveries of gold or base metals, the only advances into new ground being in uranium and beach sands. In the base metal field the future of the industry still depends upon the location of possible repetitions of orebodies in existing mines, the extension of known ore occurrences, or the discovery of some associated ore occurrence. Fortunately the large gold, lead-zinc and copper mines promise substantial futures—conditional on metal markets and costs—but on present facts, the more distant future of these particular metals would seem to lie in the group working of small mines.

The country has been well searched by large exploratory organizations without finding anything that met their requirements for size. This has been the verdict of overseas, as well as local companies, but a number of their rejects might well become producers under group working, given sympathetic Government consideration in regard to facilities and taxation.

The equitable balance between lessened taxation and increased national wealth, and the utilization of assets through satisfactory encouragement, that are now likely to be irretrievably lost, does not seem to be appreciated by governing entities. The withdrawal of taxation on mining profits until, at least, subscribed capital has been returned, would have a very marked influence on new enterprise as well as on the utilization of large tonnages of low grade or marginal ore that are uneconomic under existing conditions, but which are nationally, very important.

This consideration would also react in renewed interest in old abandoned fields of potential promise, whose re-examination is prevented by the high cost of dewatering and reconditioning, with the overriding burdens of ultimate heavy taxation and greatly diminished reward, if any.

Winkelhaak Mines—Pioneer Gold Producer in the Bethal Area

(From Our South African Correspondent)

Winkelhaak Mines Ltd. formed under the aegis of Union Corporation to exploit a mining lease totalling some 5,115 claims in the Bethal district some 70 miles east south-east of Johannesburg was incorporated in South Africa on December 7, 1955.

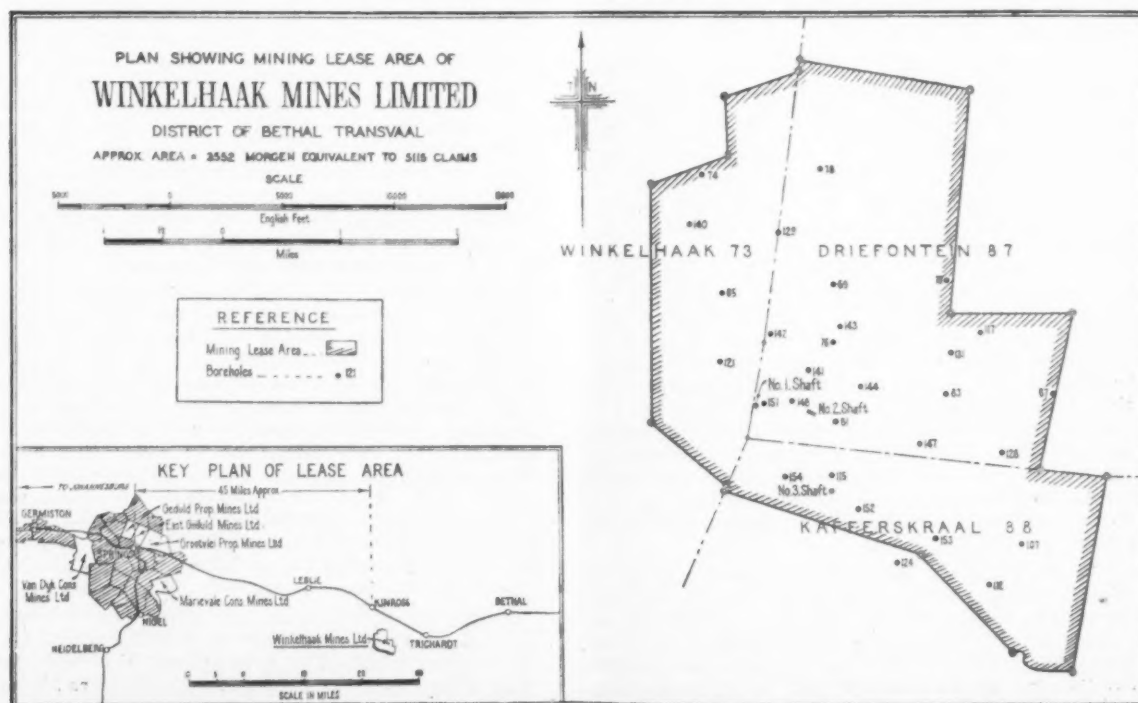
The drilling of the area was carried out by Capital Mining Areas, a wholly-owned subsidiary of Union Corporation during the years 1950-1955. Twenty-eight boreholes were drilled within the lease area and one borehole was put down immediately adjacent to the lease area. Of the 29 boreholes, 17 intersected the Kimberley Reef, 11 failed to intersect that Reef because of faulting and one went through the Karroo system cover directly into beds of the Witwatersrand system which lies south of the sub-outcrop of the Kimberley Reef in this area. This exploration programme revealed a number of major upthrow faults in the area which had the effect of creating a series of reef horizons at relatively shallow depths. Other essential data disclosed was that the Kimberley Reef sub-outcropped on the southern boundary and dipped northwards at between 25 and 30 deg.

From the drilling programme it would appear that the Kimberley Reef is the only economic horizon in the area as eight of the boreholes put down were continued to the Main Reef horizon but failed to yield payable values. One interesting and perhaps unfortunate feature is that the Kimberley Reef at Winkelhaak, unlike its counterpart in the Daggafontein area, on the Far East Rand, did not carry payable uranium values. However, the reef is wide and averaging as it does 26 in. should permit easy and economical mining conditions which, because of the 25 deg.

dip, can be assisted by the use of scrapers. At this early date, it is not possible to say with any conviction whether reef sorting as practised in some of the mines on the West Wits line can be used to any major extent but if this should prove possible a higher milling grade could, of course, be achieved.

When considering the values obtained from the exploratory drilling programme a number of factors not readily apparent ought to be borne in mind before any clearcut assessment of the potential worth of the area can be reached. First of all, the boreholes put down on Winkelhaak form only a portion of a much greater exploratory grid. Thus the fact that only one borehole yielded values in excess of 1,000 in. dwt. on the Winkelhaak property does not mean a great deal as several results obtained elsewhere in the Bethal area have given values of this magnitude. Moreover, very few of the cores were complete, so that it can be assumed with reasonable safety that the true borehole values will be in excess of those recorded. Similarly, on the basis of past experience elsewhere development values will probably turn out to be better than that indicated by the drilling results.

Averaging all the values obtained it would appear that the overall value of the property—allowing for the 20 per cent call factor—is approximately 305 in. dwt. On this basis and taking a stoping width of 42 in. a milling grade of 7.5 dwt. per ton, though somewhat on the optimistic side, would not appear to be unreasonable. And, as aforementioned, if reef sorting can be used to any major extent a milling grade of 7.5 dwt. per ton could well err on the low side. In any event when looking at the



overall drilling pattern the values obtained are similar to those in the Lucas Block in the Klerksdorp area, where, it may be recalled, there was only one borehole result in excess of 1,000 in. dwt. gold per ton in what is now the Stilfontein lease area.

Percentage payability it is believed will prove to be satisfactory. This opinion stems not only from the assumption that the true borehole values will be in excess of those obtained from the incomplete core recoveries, but primarily because unpayable reef values occur in what can be described as large patches which are clearly distinct from the payable reef areas. Therefore it ought to be possible to leave these large blobs of unpayable ore in position or, if convenient, to mine them as waste for back-fill. In this connection the situation differs from the Vaal Reef areas where virtually the whole formation of unpayable ore had to be removed and hoisted as reef.

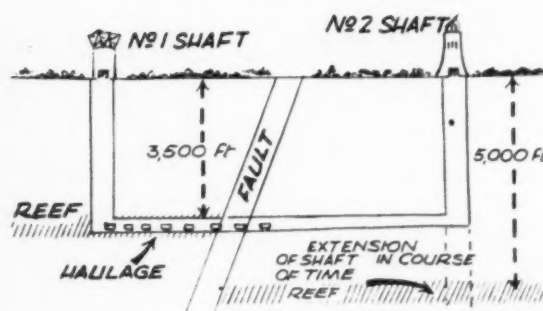
WORKING COSTS AT 40s. PER TON

In view of Union Corporation's record with its pioneer mine in the Orange Free State, St. Helena, whose operating costs are approximately 41s. per ton there seems to be no *prima facie* reason why Winkelhaak's costs per ton should be much above, if at all, the average for the Central Rand. For the purpose of assessing Winkelhaak it can be reasonably assumed that working costs will be 40s. per ton. On this basis and taking a milling grade of 7.5 dwt. per ton the gross working profit is 54s. per ton milled.

The company prospectus suggests that it will take about two-and-a-half years to reach the production stage. But mining circles in Johannesburg are of the opinion that this estimate may well prove to be over conservative. This contrary but happy view is rooted in the experience gained with the development of the mines in the Orange Free State when the original assumptions were that operations would proceed smoothly and without difficulty. That being so Union Corporation's declaration, conservative or not, is undoubtedly the correct one to make. Nevertheless, should the Bethal area prove to be relatively trouble free the production stage may well be reached much earlier than originally stated.

Hartebeestfontein in the Anglo-Transvaal Consolidated group and one of the youngest developing properties in the Klerksdorp area provides a good guide as to what can be done under similar circumstances. This mine entered the list of producers in the very short time of two-and-a-half years. Winkelhaak has the added potential advantages of the experience gained in the O.F.S. and at Hartebeestfontein and also that its reef horizon is considerably shallower than in the Klerksdorp area. More than that the first shafts are to be smaller than at Harties and No. 1 shaft should intersect the reef at around 1,000 ft. and the No. 3 shaft at possibly 900 ft. While this does not constitute staggered reef planes as distinctive as those at Harties and clearly illustrated in the diagram on this page. Nevertheless, the "telescoping" mining technique used at Hartebeestfontein might be applicable at Winkelhaak. If good ground is encountered it should be possible to emulate recent excellent shaft sinking performances and complete sinkings in about three months. Both shafts have been sited in areas where borehole results have been relatively high, so that it might not be too long before development results become available.

One interesting and somewhat radical change in South African mining procedure used at Hartebeestfontein was the erection of the reduction plant by a private firm of construction engineers instead of being undertaken by the mine itself. In that case, the whole shaft was completed in less than ten months compared with the customary year and a half. It is not known whether this procedure will



The mining programme applied at Hartebeestfontein Gold Mining

be adopted at Winkelhaak but if it is a further saving of time on the estimated period for bringing the mine into production is a good possibility.

OUTLOOK FOR WINKELHAAK

Examining the structure of the company and its prospects over the next few years it would appear possible that it could be financed right through to full capacity without having recourse to issuing more ordinary shares than the present subscribed capital of £6,000,000.

According to the mine's technical advisers, the property should be able to mill 60,000 tons a month by the end of the first year of production. Taking the working profit of 54s. a ton and an average milling rate of 30,000 tons per month for this initial period the gross working profit would be about £90,000 a month. In the second and subsequent years the working profit at this rate would rise to approximately £1,900,000 a year. If the foregoing can be taken as being a more or less true reflection of the profit position the first three years of operation will provide the major portion of the total of £4,500,000 envisaged as being the remaining amount to finance the mine to its full production stage. Assuming that the initial development results are satisfactory it may well be that the balance could be raised by loans or debentures. In this connection the issue of shares to other groups and institutions listed in the prospectus would appear to be significant. Apart from Union Corporation it is interesting to note that two powerful American companies—The American Metal Company and New Mining Corporation—are among the subscribers which also include Anglo American Corporation, Central Mining and Investment, Anglo-Transvaal Consolidated, General Mining and Finance, Johannesburg Consolidated Investment, New Consolidated Goldfields, Rio Tinto and, the Federale Mynboumaatskappy Beperk.

From a market point of view the crucial question is what of dividends and share values? When full capacity is reached gross earnings should be of the order of £270,000 a month equivalent to £3,240,000 a year. The lease formula is favourable involving the payment of only nine per cent—a gesture given in favour of the mine because of its pioneering position in the same way as was afforded to St. Helena for the same reason in the Orange Free State. When ordinary tax is added the final liability should be approximately 50 per cent. Deducting this charge and allowing for other contingencies distributable profits should be of the order of slightly over £1,500,000 a year. Assuming the ordinary share capital is not increased this is equivalent to payment of between 2s. 3d. to 2s. 6d. per share.

If, however, further shares are issued these potential dividend payment figures must be adjusted accordingly. Nevertheless, calculated on a 10 per cent yield basis, the value of the existing shares could be put as high as 27s. 6d. per share.

Developments in the U.K. Coal Mining Industry

Many of the developments taking place within the U.K. coal mining industry result from the technical ability of personnel of the industry, in addition to those advances made through the research programmes instituted by companies or professional bodies. The following article describes several of these developments, maintaining our practice of presenting in précis the latest technical advances reported in coal mining practice.

An application for the radio-telephone has been found in opencast coal mining by Robert McGregor and Sons, who are utilizing draglines on an opencast contract for the N.C.B. in an area between Leeds and Leicester. As payment is only received for coal delivered, and as the coal averages a depth of 60-70 ft., it is essential that overburden removal and actual mining operations be concluded in the minimum of time.



A message being radioed to the main office from an outlying site

To speed communication between the various sites, Pye radio-telephones were fitted to certain vehicles, and the contractors anticipate delivering coal within seven days of moving to a site, while requests for fuel and spares can now be dealt with immediately. At present three trans-portables are in use at site offices and three "reporters" on vehicles, and delivery of coal has been greatly accelerated.

Amongst the Pye Telecommunications Ltd. equipment included in the system, are the Radiophone fixed and mobile equipments. The fixed equipment, Series PTC 703Z/704Z is a self-contained fixed station for V.H.F. Radiophone schemes, and is ideal for headquarters station. Frequency range is from 60 to 100 Mc/s and 100 to 184 Mc/s. The Reporter, Series PTC 116/117 operates on identical frequencies. The Reporter is light and mobile and is presented as ideal for many mobile uses, where the installation of high-power equipment is impracticable.

PRESSURE ON PROP HEADS

By replacing the pump mechanism of a Dowty prop with the mechanism from a Dowty Bar Straightener, a hydraulic jack has been produced at "B" Winning Colliery, East Midlands Division, which facilitates the lifting of arches from the floor, particularly at a back ripping. The invention enables a 20 ton pressure to be put on the head, compared with the 5 tons which is the pressure achieved with the unmodified prop. In every case so far this 20 tons pressure has been sufficient to pull the arch out of the floor.

Stability is achieved by welding the prop to a channel iron base, and a rotatable head is welded to the top of the prop. To this head is fitted a bracket which clamps to the flange of the girder to be pulled out. In operation the clamp is put on the girder at the right height from the floor to enable the jack to be inserted under it. Pumping action is provided by the ordinary Dowty prop handle.

A shock absorbing attachment for use with large mine car tipplers, when these have no such device incorporated in the design, has been devised in No. 3 Area, Northern (N. & C.) Division, N.C.B. Its object is to prevent damage to tippler rings and carrying and driving wheels when mine cars enter at speed.

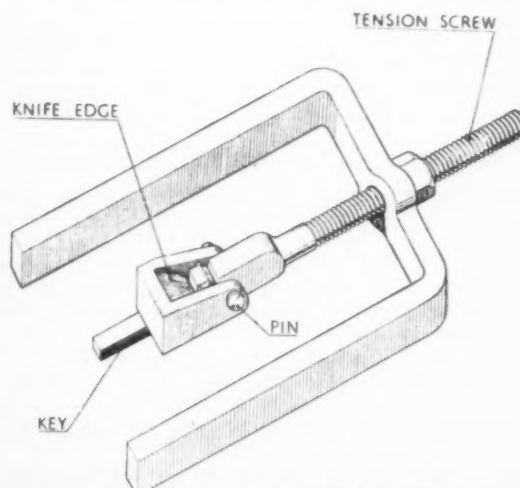
The device consists of a steel box frame fitted with a spring-loaded carrying head. On this head are mounted one or two roller wheels, according to necessity, rotating on heavy stub shafts. These wheels are so positioned that under the tension of the springs, they make contact with the periphery of the tippler ring and rotate in sympathy with the ring's travel.

Each spring can be separately adjusted to give the necessary pressure on the ring. Double wheels are usually necessary on the box which takes the main thrust; at the opposite end of the tippler a single wheel is sufficient to check the recoil.

A KEY EXTRACTOR

An extractor for withdrawing keys which lock pulleys to shafts has been devised at Markham Colliery, near Chesterfield, and is proving useful at washeries and other installations located some distance from colliery workshops.

The device consists of a U shaped bar, a tension screw which passes through a hole bored through this bar, and a U shaped steel forging embodying a knife edge to engage with the key being removed. This knife edge can be attached firmly to the forged steel head of the tension screw by means of a pin of high tensile steel. Force is applied to the key, through the bolt, by turning a nut which is



The key extractor devised at Markham Colliery

placed on the tension screw on the far side of the main U arm.

In operation the jaws of the U shaped arm are placed in position up to the hub of the pulley. The forged head of the tension screw is placed under the key. The knife edge, which fits over the key head (with a flat key a cut has to be made to take the knife edge), is then placed in position and firmly connected to the head of the tension screw by the steel pin. The adjusting nut can now be turned with a spanner to exert a steady pull until the key is free.

A wedge-type tubular prop has now been adapted with success in the Scottish Division. The prop consists of two Stewart and Lloyd rigid tubes arranged telescopically. The bottom tube acts as a guide for the top tube, which slides inside it under the action of a wedge. Top tubes of different lengths can be used to suit changes in seam thickness. A half-inch plate is welded to the base of the top section. This plate is in direct contact with the top of the wedge. The wedge itself, which can be either fabricated or cast, is 12 in. long, tapering from 4 in. to about 1 in., and has a T shape welded to the small end to prevent the

wedge being lost and also to take hammer blows when being released.

In operation the wedge enters a slot cut in the lower tube and is driven between the base plate on the top section and a wedge seat which is arc welded to the bottom tube.

An adjustable platform, which allows a fixed-turret coal cutter, mounted on an armoured conveyor or on a floor based platform, to be adjusted with the ease of a cutter fitted with a hydraulic turret, has been developed in the N.E. Division.

On the new design, the base plate bolts are secured through slots in vertical brackets welded to the sides of the platform. The faces of these slots are serrated to correspond with serrated washers on the clamping bolts. Considerable adjustability of the platform can be made prior to the clamping bolts being made secure, when the whole then becomes a rigid structure. Adjustment is effected by four or more small diameter hydraulic jacks which pass through the platform plate and act directly on the base plate of the machine.

Properties and Applications of Chlorinated Rubber and Chlorinated Paraffin Wax

Neither chlorinated rubber nor chlorinated paraffin wax are derived from man-made polymers, and both substances owe their fire-resistant properties to the presence of large amounts of chlorine in the molecule. The following article, describing the properties and applications of these materials, is condensed from a paper presented at a symposium on Flame Resistant Polymers held in London in November, 1955, under the auspices of *Rubber and Plastics Age* and is published by permission of the organizers. The author is H. E. Parker, M.Sc., A.R.I.C., of the Technical Service Department, I.C.I., General Chemicals Division.

In the middle of the 19th century patents were taken out by Parks and then by Engelhard and Day for the production of a chlorinated rubber, and the first formula— $C_{10}H_{13}Cl_7$ —was given by Gladstone and Hibbert in 1888, but it was not until 1915 that Peachey recognized its value as a film-forming medium.

Chlorinated rubber, when first marketed in this country, was sold as a solution in carbon tetrachloride under the name Duroprene. It was, however, soon found more convenient to isolate the chlorinated rubber itself and this has been generally available for about 20 years, during which time its usefulness has been recognized until now several thousands of tons are used annually throughout the world.

All the main producers market a range of products which differ according to the viscosity of their solutions in toluene. Using a 20 per cent solution at 25 deg. C. the various grades have viscosities ranging from 5 or 10 centipoises up to somewhat over 100 centipoises.

PROPERTIES OF CHLORINATED RUBBER

For almost all purposes chlorinated rubber must be dissolved and applied from solvent solution. A chlorinated rubber film produced by evaporation of a solvent solution is nearly colourless. It has a tensile strength of about 5,900 lb./sq. in., but finds no application because of its brittle nature. This brittleness can be overcome by the use of plasticizers.

The main properties of chlorinated rubber are:

- (a) Inertness—resistant to chemicals (acid and alkali);
- (b) Low moisture permeability of the same order as polythene—hence its use in underwater paints;
- (c) Non-inflammability; and
- (d) Compatibility with resins, natural and synthetic, Neoprene, etc.

For purposes of fire and flame resistance the non-inflammable plasticizers should, of course, be employed. These include chlorinated diphenyls, the chlorinated paraffin waxes and phosphate plasticizers. The most common chlorinated paraffin wax, marketed in England under the trade name of Cereclor, contains about 42 per cent chlorine and has an approximate formula of $C_{22}H_{15}Cl_7$.

Other liquid grades of chlorinated paraffin waxes are available, the viscosity of which increases with increasing chlorine content.

The chlorinated paraffin waxes are finding increasing use, not only as plasticizers or extenders in plastics—e.g. PVC—but also in mild extreme pressure lubricants and cutting oils.

USE IN FIRE-RETARDANT PAINTS

It is suggested that the first logical use of the non-inflammable film-forming media is in fire-retardant paints.

A typical basic formulation depends on the use of calcium carbonate and antimony oxide with the chlorinated rubber, together with a pigment such as titanium dioxide. The calcium carbonate acts as a fire-retardant in its own right, but is also an acid acceptor should the chlorinated body break down under the action of heat. Antimony oxide in reacting with the breakdown products forms antimony chloride which acts as a flame suppressant. Best flame resistance is obtained with matt or semi-gloss paints.

For outdoor, where weathering is of importance, the chlorinated body, e.g., chloroparaffin wax with 70 per cent chlorine and antimony oxide can be used to impart flame resistance to linseed oil or alkyd-type paints. In a similar way the use of chlorinated rubber with alkyd paints is well

worth a trial. In this case, the chlorinated rubber reduces the drying time and increases the hardness of the alkyd.

Incidentally, the straight chlorinated rubber paints with chloroparaffin wax as plasticizer can be used on asbestos or concrete—i.e., alkaline surfaces to which they have good adhesion. Spread of fire by the paint film itself is thereby prevented.

Objection has been raised on occasion that the chlorinated compounds give rise to dangerous gases such as phosgene or chlorine when subjected to heat. This matter has been carefully investigated by Costa for chlorinated rubber. In no case could either phosgene or chlorine be detected in the decomposition products of the chlorinated rubber as long as non-oxidizing pigments were used. When, however, oxidizing pigments such as lead chromate are used with chlorinated rubber appreciable quantities of chlorine are formed on heating.

Chlorinated rubber plasticized with excess chloroparaffin wax (42 per cent chlorine) may be used as a binder for organic substances used to impart flame resistance to certain textiles. During the last war, chlorinated paraffins were much used in the treatment of camouflage scrim which had to be weather-resistant and fire-resistant. A typical emulsion formulation with chlorinated paraffin wax which competes with flame-proofing finishes based on the more toxic chlordinophenyls or chlorinated naphthalenes is:

Material	Per cent	Material	Per cent
"Cereclor" 54	14.0	Water	52.0
Antimony trioxide	14.0	"Cellofas" A	0.5
Glue	1.5	Solvent (white spirit)	
Stearic acid	2.0	solvent naphtha 60/40	16.0

After impregnation the cloth must be dried and then treated by immersion in a 10 per cent aluminium trifluoride solution at 65-70 deg. C.

A typical specimen of treated cotton duck had the following characteristics:

Per cent total pick-up by weight, 26.3 (3.1 oz./yd. on 12 oz. cloth); Flame resistance, After burn—nil, After glow 94 sec.; Water permeability (13 in. head 3 in. dia.), Before rubbing out—0.6 ml. in 10 min., After rubbing out—2.5 ml. in 10 min.

A CHLORINATED RUBBER FORMULA

Samples of 12 oz. cotton duck were impregnated in the following solution, part exposed in South Africa and part retained:

Material	Per cent	Material	Per cent
Chlorinated rubber	4.7	Zinc carbonate/borate	11.4
42% chlorinated paraffin wax	9.3	Calcium carbonate	5.0
Copper stearate	1.0	Chrome oxide	4.2
Antimony oxide	6.4	Trichlorethylene	58.0

A 60 per cent pick-up of solids gave a non-inflammable cloth with an after glow of about 30 sec. After six months in South Africa the original cloth had tendered considerably, the fluidity of the cotton having increased from 3.5 to 21 whilst that of the treated material had risen only to 6.7. The glow time after exposure was about 40 sec.

Samples treated for mildew resistance with one per cent dichlor dihydroxy diphenyl methane (Proxel A) have been given a 51 days' soil burial test with the following results:

Per cent pick up in treatment	45
Glow time:	
Before soil burial	28 secs. average
After soil burial	31 secs. average
Water permeability:	
Before	nil in 10 minutes
After	2.6 ml. in 10 minutes

The use of pentachlorophenol gives similar results.

A practical case of flame-proofing occurred when a fire broke out at a works due to a spark from a welder's torch setting fire to a surround sheet. The following formulation was therefore prepared for painting on the sheets:

Material	Per cent	Material	Per cent
"Alloprene" B	8	Chrome oxide	4
"Cereclor" 2	16	Micro crystalline wax	3
Antimony oxide	9	(This for added flexibility)	
Zinc borate	3	Copper stearate	1
Calcium carbonate	16	Toluene	40

When one side was treated there was an after burn of 7 sec. and after glow of 55 sec., whilst if both sides were treated there was no after burn and glow time of 40 sec.

Treatment of the surround sheetings is now standard accident prevention practice at the works. This method of treatment can, by suitable choice of pigments, give a wide range of colours. A similar suspension is suitable for application to blast mats.

SUITABLE POLYMERS

Chlorinated paraffin wax is compatible with a wide range of polymers. In PVC compositions, since the basic material contains about 57 per cent chlorine, the unplasticized polymer is non-inflammable, and the inflammability of the plastic compositions will depend on the plasticizer employed. For complete non-inflammability, plasticizers of the phosphate type are generally used, whilst for other purposes the most commonly used plasticizer is dioctyl phthalate.

Chlorinated paraffin wax, 42 per cent chlorine, can be used to replace up to 40 per cent of the primary plasticizer in such compositions, thereby tending to reduce the inflammability of the product. Some brattice cloth and ventilation duct based on PVC incorporate Cereclor as a secondary plasticizer.

For other types of plastics which contain no chlorine a chlorinated paraffin wax must be used in conjunction with antimony. Thus, in the case of the Nuron resins and polyesters generally, the plastic can be rendered self-extinguishing by the incorporation of chlorinated paraffin wax, containing 70 per cent chlorine, and antimony oxide.

USE OF CERECLOR 70

The use of Cereclor 70 and antimony oxide to increase the flame resistance of polythene was described in 1953, and patents have been taken out. In this case, 56 per cent by wt. of Alkathene was mixed with 28 per cent of antimony oxide, 15 per cent of Cereclor 70 and one per cent of antioxidant to give a product to meet the British Standard Specification 559 and which could be used for cables in coal mines.

The advantages claimed for the above are that the flame retardant is easily processed, has good electrical properties, does not drip or spread fire, is resistant to tracking and has satisfactory abrasion resistance. It has an operational range temperature from -60 to +70 deg. C., does not exhibit cold flow and is less expensive than polythene. In a similar way, the cellulose acetate butyrates and polystyrenes can be rendered flame resistant.

The addition of Cereclor 70 and antimony oxide to natural rubber for fire resistance can be effected in a similar manner. Compounded rubbers containing the chlorinated paraffin wax and antimony oxide do not propagate flame and are self-extinguishing in horizontal tests but not in vertical tests. As they are inferior to Neoprene compounds in fire resistance and physical properties, it does not appear that there is likely to be much advance in this direction.

TECHNICAL BRIEFS

Germanium and Silicon Transistors

A new and improved technique for making transistors and other "solid state" devices from germanium has been developed at the Westinghouse Research Laboratories. The new technique has already been employed to make two greatly improved types of transistors: (1) a transistor capable of efficient operation at extremely high frequencies such as those encountered in television and other high-frequency electronic devices, and (2) a special transistor, known as a photodiode, which is 10,000 times more sensitive to light than a conventional photoelectric cell, or "electric eye," yet can control a hundred times more current.

Dr. R. L. Longini, physicist at the Westinghouse Research Laboratories, describes the new technique as an improved means of making "junction type, p-n-p" germanium transistors. Such a transistor resembles a sandwich made up of two different kinds of germanium. The "filling" of the "sandwich" is a layer of n-type germanium, so-named because it contains an excess of negative carriers of electricity, or electrons. On each side of it are layers of p-type germanium, which have an excess of positive charges due to lack of electrons. N-type germanium is converted to p-type by "doping" it with tiny traces of a metal such as indium or aluminium. Only one atom of the metal in many millions of germanium atoms is enough to cause the change. The key to the Westinghouse process is a "cooling off" period during the heating of the transistor sandwich, which allows the critical n-layer to build up the desired thickness and uniformity instead of being dissolved away.

The General Electric Research Laboratory reports additional progress in the quest for extremely pure silicon crystals, as a result of which it is now prophesied that silicon may surpass germanium in its importance as a semi-conductor element. Although more difficult to process, it has the fundamental advantage of being able to operate through a greater temperature range.

Determination of Copper in Soil and Rocks

A rapid method for the determination of traces of copper in soils and rocks under field conditions and in the laboratory was described in U.S. Geological Survey Bulletin 1036—A. The method involves fusion of the samples with potassium bisulphate and estimation of copper with biquinoline in an isomyl alcohol extract, and is useful for prospecting and for gathering basic geochemical data.

In the rapid laboratory method and its field adaptation, a pyrosulphate fusion of a powdered soil or rock sample, followed by extraction into hydrochloric acid, dissolves essentially all of the copper. Neither sulphate nor chloride interfere with the biquinoline method, so this treatment is suitable for dissolving copper from soil or rock. Hydroxylamine is added to an aliquot to reduce copper (II) to copper (I), tartrate to complex iron and aluminium, and acetate to buffer the solution. The copper biquinoline complex is then extracted into isomyl alcohol. Field and laboratory techniques differ only in that, in the former field stoves are used rather than Bunsen or Fischer burners, measurement of volumes is approximate rather than exact, and estimations are made by comparison with a standard series rather than instrumentally.

The fusion with potassium bisulphate followed by extraction with hydrochloric acid dissolves copper in soils and rocks. The final acidity of the hydrochloric acid solution has to be such that on standing overnight the copper content of the solution will be the same as the copper content of the freshly prepared solution, because frequently the copper in samples is decomposed in the late afternoon of one work day and aliquots for estimation are not taken until the next morning. Replicas of a sample in 0.3 N. hydrochloric acid analyzed within one hour after dissolving the copper and replicas of a sample analyzed after standing overnight show the result of too low an acidity.

The precision and accuracy of the field method were determined by analyzing 30 soil and rock samples by a carbonate laboratory method. These samples were analyzed by the field

method in duplicate. The first 27 samples ranged from the highly silicic rocks to the basic rocks. With each fresh rock, the corresponding weathered rocks and overlying soils were analyzed.

The 95 per cent confidence level of the field method was examined by analyzing three samples by the field method five times and applying results to fixed equation. The 95 per cent confidence level of the rapid laboratory method was examined by analyzing the same three samples four times by the rapid laboratory method and again applying the results to the equation.

Welding of Aluminium and Its Alloys

A welding research team was formed by the Aluminium Development Association to investigate the reasons why certain aluminium alloys are not readily weldable and—as a result of the information so obtained—to suggest modifications to chemical composition, mode of manufacture or welding procedure which might lead to the production of good, high-strength welds.

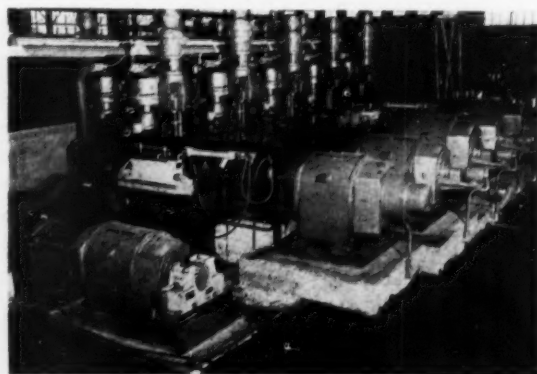
Many commercial aluminium alloys are not readily weldable, principally because they crack at temperatures above the solidus during welding or at much lower temperatures during cooling of the weld complex. Cracking at temperatures above the solidus also occurs in castings of certain aluminium alloys.

Investigations were, therefore, undertaken to obtain information regarding the factors which affect cracking during either operation, with the object of formulating a general theory of the occurrence of cracking. On the basis of this theory it was hoped to suggest suitable methods for preventing or minimising cracking in practical conditions of welding. The factors affecting cracking at temperatures below the solidus have also been examined. A limited amount of information has been sought on the tensile properties of alloys with good welding properties, with the object of making recommendations on aluminium alloys suitable in strength and welding performance. The work of the research team from 1944 to 1950 is summarised in *Research Report No. 27*, published by the Aluminium Development Association. Price 7s. 6d.

Copper Strip Mill Control by Betameter

An example of how the betameter can be installed for automatic process control and meet conditions and standards peculiar to a specific industry is provided in a recent installation at the New Toronto, Ont., plant of the Anaconda American Brass Ltd.

This is a double betameter installation designed to control the first and fourth stand of a five stand rolling operation. The mill in this case rolls copper strip 10 in. wide. It can travel up to 1,700 ft. per min. A Model A betameter is mounted so that



A view of the mill. One betameter is seen front left, the second is at the far end of the mill



Copper strip passing through the four channel pinhole detector

the measuring head is in the centre of the sheet and thus controls average weight.

The combined characteristics of high density and high atomic number of copper means that an energetic beta ray must be employed to penetrate the sheet. To meet this necessity, Isotope Products have used isotope strontium 90 in both of these gauges at the Anaconda plant.

In the Anaconda installation, the two betameters are linked with motors which screw the respective first and fourth sets of rolls of the mill up or down. Thus the sheet is thinned or thickened as it tends to vary from the pre-set standards. With this installation control is possible—and quite practical—to .0001 of an inch of the pre-set thickness.

Isotope Products have also provided Anaconda with another type of instrument which is used to control inspection of copper strip. This is a pinhole detector for finding minute holes in copper foil. Holes down to .0001 of an inch in diameter can be detected.

This instrument is a photoelectric device which is activated by a light beam passing through pinholes. The light beam activates a photomultiplier tube. On the original 10-inch strip of copper sheet a four-channel pinhole detector is used. Each "eye" scans a two to three inch strip of the sheet for flaws.

Bright Cadmium Plating

A new Cadalume process for bright cadmium plating in still tanks, announced by Hanson-Van Winkle-Munning Company, introduces a simple-to-operate, low-cost bath for the production of bright, uniform and attractive cadmium deposits. The brightener may be added directly to the bath, no breaking-in period being required. The desired deposit brightness appears immediately in a balanced bath. The process is used to protect iron and steel parts against corrosion, and non-ferrous metals against surface tarnish, corrosion or galvanic couples formed in assemblies. Though the deposit is claimed to have exceptional brightness, as deposited, on deeply recessed work, a 1 per cent nitric acid bright dip may be used to brighten low current areas.

Enamelled Aluminium

The Aluminium Co. of America has developed a new process for porcelain enamelled aluminium which is expected to result in substantial savings in manufacturing costs.

The process is a pre-enamelling chemical treatment, and is said to eliminate multiple chemical baths and a pre-firing operation hitherto necessary to ensure controlled surface conditions. It is reported to produce a uniform, condition surface in one step, leaving the metal ready for porcelain coating.

REVIEWS

Mine Rescue Work, by R. McAdam and D. Davidson. Published by Oliver and Boyd Ltd. Pp. 183 with illustrations and index. Price 21s.

This book has been written with the dual purpose of providing an up to date text-book for mining students together with a work of reference for members of rescue brigades, men attached to permanent rescue corps, and production officials in the mining industry.

In addition to describing the construction and action of breathing and reviving apparatus, concise accounts are given of the associated subjects with which trained rescue personnel must be familiar, namely fire fighting, mine gases, mine plans, and the organization of rescue work. Illustrated descriptions are given of all important rescue apparatus commonly used in the United Kingdom, and reference is also made to important and unusual types of apparatus used elsewhere. The authors are respectively Professor of Mining in the University of Edinburgh and the Heriot-Watt College, and superintendent of the Heriot-Watt College Central Mine Rescue Station.

The South African Mining and Engineering Year Book. Published by the South African Mining Journal Syndicate Ltd. Price 63s. Postage extra.

Continued expansion in the mining and engineering industries of South Africa is reflected in the 1955-1956 edition of *The South African Mining and Engineering Year Book*. As in previous years, the work is divided into two complementary parts. One section is primarily a record of progress in the gold, diamond and base metal mining industries of South Africa, but also covers such major secondary industries as electricity supply, iron and steel, and oil from coal.

The second section is a directory compiled to serve all doing business with the Union's mining and engineering industries. The latest edition incorporates also *The Rhodesian Mining Year Book*, formerly produced as a separate volume, in which the progress of the copper mines of Northern Rhodesia is reviewed in detail.

Minerals Yearbook, Area Reports, Vol. 3. Prepared by the field staff of the U.S. Bureau of Mines, Regional Mineral Industry Divisions. Pp. 1050. Price in Washington \$3.75, cloth backed.

The presentation of the *Minerals Yearbook, 1952*, in three volumes initiates a change made necessary by an increase in material. In the current presentation in three volumes, Volume I is made up of chapters on mineral commodities, both metals and non-metals, but exclusive of the mineral fuels. Volume II is devoted to the mineral fuels.

Volume III, here under notice, is made up of chapters covering each of the forty-eight States, and presents data on Alaska, the Territories and island possessions in the Pacific and Caribbean, and includes the Canal Zone. This volume also contains a chapter recapitulating statistics in summary form on a regional basis, while a further chapter presents data of employment and injury by regions.

The Arc Welding of Aluminium; Information Bulletin No. 19. Published by The Aluminium Development Association. Pp. 92 with illustrations.

This new Information Bulletin deals with the electric arc welding processes applicable to aluminium, and is dedicated to practice, not being directly concerned with metallurgical principles.

Notes on factors governing the welding arc in general precede a brief description of the characteristics of aluminium in relation to arc welding; and this leads, in turn, to a discussion of the weldability of aluminium alloys by the various arc processes. Tables, relating the cast and wrought alloys to the arc processes in order of suitability, list the appropriate filler rods and also show the mechanical properties to be obtained from the alloys unwelded, and as welded.

Separate sections deal with inert gas shielded arc, metal arc and carbon arc welding.

MINING MISCELLANY

A diamond weighing 315 carats was found by a digger at Nooitgedacht, a De Beers farm leased to diggers. A perfect octahedron, it was sold for £15,000.

Belgian imports of uncut diamonds last year totalled 3,731,697 carats worth £24,753,157, compared with 2,561,011 carats worth £18,855,847 in 1954.

The discovery of large quantities of sulphur and asphalt in Northern Syria has been announced by the Director of the country's Mineral Department.

An ordinance to ratify the new diamond agreement between the Government and the Sierra Leone Selection Trust has been passed by the Legislative Council of Sierra Leone.

A factory to produce 20,000 tons of sulphur annually has been opened at Hinogedo, near Torrelavega, Spain. This output should render further imports of sulphur unnecessary.

Copper production at the Ergani mines, Turkey, amounted to 19,235 tonnes in 1955, including 14,700 tons of blister. Output at the Murgal mines was 8,800 tons, all blister.

The Showa Denko Company has concluded a contract to export 2,000 tons of primary aluminium to Australia during 1955, at a price of over 204,000 yen per tonne, F.O.B., through the Daiichi Bussan Trading Company.

Mining Corporation (Australia) N.L. has obtained assays of 1.8 and 1.6 per cent cobalt on a site 300 feet north of the old Mount Cobalt mine. A wide body of mineralization had been disclosed in which Mt. Cobalt lode continued northwards.

It is reported from Cuba that a third of the projected expansion of the Nicaro nickel plant has now been completed. Shipments of nickel and cobalt from Moa to New Orleans for testing have begun.

Investigations of importance to prospecting and mining are reviewed in the latest issue of *Colonial Geology and Mineral Resources*, the quarterly bulletin of the Colonial Geological Surveys (Vol. 5, No. 4, 1955).

The Soviet Union and the Korean Democratic Republic have signed a trade agreement. Korean exports to the Soviet Union will include lead, ores and concentrates of non-ferrous metals, and non-ferrous alloys. Exports from the U.S.S.R. to Northern Korea will include ferrous and non-ferrous metal, as well as building materials and other commodities.

The Government of Pakistan have for some time been considering the formation of a Bureau of Mines to co-ordinate a programme of sound expansion of the country's mining and mineral resources on proper scientific lines. To assist in this task the Government has acquired the services of Mr. John L. G. Weysser, a highly qualified mining engineer from the U.S.

The Belgian Congo exported 175,296 tons of copper in the first nine months of 1955 against 166,245 tons in the comparable period a year earlier. Exports of cadmium amounted to 25 tons against 14, while those of manganese ore reached 196,049 tons (172,118) and those of columbium-tantalum ores 515 tons (368).

It has been reported from Blantyre, Nyasaland, that a well-known South African mining group will start intensive prospecting in Central Angoniland when the present rainy season is over. The company proposes to send teams to the area and to use aircraft fitted with magnetometers. Deposits of mica, graphite and similar minerals have already been proved.

The Japanese Government is making foreign exchange available for additional imports of raw materials in view of increased domestic production, caused mainly by exports. The Ministry of Trade's plan, which is subject to Cabinet approval, calls for additional imports of about 200,000 tons of scrap steel, about 200,000 tons of iron ore, and about 100,000 tons of coking coal.

The Diamond Trading Company recently announced a sale of £3,000,000 of rough diamonds to Harry Winston Inc., of New York. This is the largest single sale of rough diamonds ever made to an individual firm. Included in the transaction is an outstanding blue-white diamond weighing 426 carats, which Sir

Ernest Oppenheimer has described as "the most magnificent stone ever discovered in South Africa."

Productivity rose in Hungary's State industry last year by 6.1 per cent. It is claimed that all sections of industry overfulfilled their production plans, the average being 103.2 per cent of plan. Outputs for some of the main industries include coal 22,300,000 tons (an increase of 3.6 per cent on 1954), steel 1,600,000 tons (9.3 per cent higher); alumina 154,000 tons (17.3 per cent up) and aluminium 36,998 tons (12.8 per cent up).

The U.S. Business and Defence Services Administration of the Department of Commerce has announced that 75,000 tons of aluminium will be set aside from the total supply available in the second quarter of 1956 to fill Defence Department and Atomic Energy Commission orders. This is 2,500 tons more than the amount set aside for similar orders in the first quarter of 1956 and reflects "a change in military requirements."

Continental Uranium, Inc., has acquired a 90-day option on the rights to mine and mill copper ore from the Climax No. 1 and No. 2 claims of the Atlas Uranium Corporation in the Lower Lisbon Valley, Utah. Atlas has done considerable drilling and ore delineation on the property and reports 300,000 tons of gross ore blocked out with indications of well over 1,000,000 tons potential.

Spain's Direccion General de Minas has authorized the construction of a new cinnabar distillation plant in Mieres, in the province of Oviedo. The plant, which will be equipped with a multiple bottom furnace of Spanish construction, is expected to be ready for operation within the next ten months. The raw materials, cinnabar and arsenious ores, will come from the nearby La Peno mines.

Southern Rhodesia's mineral output last year was worth a record total of £20,513,655, exceeding the previous record established in 1952 by about £312,000. Base minerals were worth £13,906,816, including £7,051,831 for asbestos. Copper, coal and tin production showed big increases, but gold production, valued at £6,582,146, was £104,860 less than in the previous year. In announcing these figures the Chamber of Mines points out that this is only the second time that the Colony's mineral production has exceeded £20,000,000.

The U.S. Department of Agriculture has reported that barter contracts—under which surplus farm products are traded with other nations for strategic and other storable minerals and materials—with an export value of \$43,700,000 were negotiated by the Commodity Credit Corporation in the quarter ending September 30, 1955. The export value of such contracts for the fiscal year ending June 30 last was \$281,800,000 and the Administration is contemplating expansion of this programme.

A report from Calcutta states that the Tata Iron and Steel Company is understood to have taken in hand a Rs.20,000,000 (£1,500,000) project for the production of ferro-manganese as part of an expansion programme. The plant will be located in the mine area of oda (Orissa), 100 miles from the steel town of Jamshedpur. It is designed and laid out for future expansion to 100,000 tons per annum. At present Tata's output of ferro-manganese is about 15,000 tons per annum.

Canadian experts who recently visited the disused copper mines at Beuparc, County Meath, are satisfied that considerable deposits of copper exist and added that more detailed surveys were to be made in the very near future. A Canadian mining company has been approached on the question of setting up an Irish subsidiary to work these mines. The text of a Bill to give the Canadian mining company concessions in developing the copper mines at Avoca, County Wicklow, has been published in Dublin, reports Comtel, and will be introduced in the Eire Parliament early next year.

The Committee on Industry and Trade of ECAFE (the Economic Council for Asia and the Far East) have adopted a modified Indian resolution emphasizing the urgency of rapid development of mineral resources in the region. The resolution requested the Sub-Committee on Mineral Resources and Development to review the report of a study group of experts which toured Western Europe and the U.S.S.R. and report on it as early as possible this year.

An Australian engineer, Mr. Geoffrey Ransford, who has worked for the Neyric plant at Grenoble in the French Alps for the last eight years has released details of a new drilling

method which, it is claimed, will bore through rock much faster than conventional gear. In tests at Montpellier the drill cut through 100 ft. of hard limestone in an hour. A series of 80 small turbines mounted just above the cutting tool drive the drill. A mixture of water and silt pumped down the shaft rotates the turbines at high speed and also cools the cutting head. French engineers of the Neyrpic works state that production of the new device would begin in about a year, or earlier if warranted by the demand.

The Olin Mathieson Chemical Corporation is to build a \$90,000,000 integrated aluminium plant in the Ohio River valley near Clarington, Ohio. The company will also join with Pittsburgh Consolidation Coal Co. and American Gas and Electric Co. to build a 450,000 kW. power plant costing \$60,000,000 to supply the aluminium factory. The power plant will be built at the mouth of a new major coal mine which will be constructed, owned and operated by Pittsburgh Consolidation. The new aluminium facility, which will include alumina and reduction plants and a rolling mill, will have a capacity of 60,000 tons of primary aluminium annually. It is expected to be completed early in 1958. A Reuter report states that bauxite for the plant will come from Surinam, Dutch Guiana.

PERSONAL

Mr. R. H. Oppenheimer has been appointed a director of Consolidated Diamond Mines of South-West Africa Limited in place of the late Mr. Louis Oppenheimer.

Herr Alfred Krupp von Bohlen und Halbach, sole owner of the Krupp industrial empire, has left for a five-week tour of Middle and Far Eastern countries. He will visit Pakistan, India, Siam and Egypt and will pay calls on heads of States.

Sir George W. Albu, Bart., has resigned from the board of directors of Rand Mines Limited. Mr. John N. Mackenzie has been appointed a director of the company.

Dr. W. J. Busschau has been appointed a director of the Harmony Gold Mining Company. Mr. E. S. Hallett has left the Board.

Mr. R. A. Hope has joined the Board of Consolidated Main Reef Mines and Estate. Mr. P. S. Hammond has left the Board.

Dr. Thomas B. Nolan, whose appointment by President Eisenhower to succeed Dr. William E. Wrather as director of the Geological Survey awaits Senate approval, has been assistant director since December, 1944.

Mr. H. N. Saunders has been appointed a director of the Rio Tinto Company.

The British Thomson-Houston Company announces that Mr. D. N. Relf has been appointed manager of transformer contracts and Mr. I. A. Ferguson manager of the mining departments—vice Mr. G. W. Edgley, who has relinquished the management of both departments before taking up another important appointment with an associated company.

Mr. A. Starr has been appointed to the position of assistant export manager in the export office of Tecalemit Limited at Brentford, Middlesex, and is responsible to the Export Manager, Mr. B. D. Waugh. After serving with the Eighth Army in all Western Desert Campaigns, he was demobilised in 1946 with the rank of Captain and joined the shipping section of Tecalemit Ltd. He joined the Export Sales Force late in 1947.

The following Capper Pass Awards have been made in respect of papers published in the *Transactions* of the Institution of Mining and Metallurgy and the *Journal* of the Institute of Metals for 1955: £100—Dr. Maurice Cook; Mr. C. L. M. Cowley and Mr. E. R. Broadfield, for a paper on "The Use of Refractories in Low-Frequency Induction Furnaces for Melting Copper Alloys". £100—Mr. P. M. J. Gray, for a paper on "The Extraction of Uranium from a Pyritic Ore by Acid Pressure Leaching". £50—Mr. W. T. Edmunds and Mr. R. C. Lloyd, for a paper on "The Production of Light-Alloy Drop Forgings, their Heat-Treatment, Inspection and Testing".

International Harvester Company of Great Britain, Limited, have announced three changes in their sales organization which became effective on January 1. Mr. Lionel H. Knight is appointed to the position of Assistant Manager of Sales. Since joining the company in 1934 he has served in many capacities, which have given him a very wide experience. Mr. Jack E. Busby has been appointed to the new position of sales engineer. He started service with the company in 1947 in the service department, of which he became manager in 1953. Mr. John F. Carroll has been promoted to the position of service

manager. He, too, joined International Harvester in 1947 and has been zone manager since 1951. The company reported a sales volume of over £12,600,000 in 1955, representing an increase of 17 per cent over its 1954 turnover.

A metallurgical and technical symposium on titanium, believed to be the first meeting of its kind in the U.S., was held at Des Moines on February 1 and 2, when representatives of four major titanium producing companies met technicians of the Solar Aircraft Company to discuss techniques and problems associated with the fabrication of titanium.

An International Conference with the theme "Chemical Engineering in the Coal Industry" is being sponsored this summer by the National Coal Board. It will be held from June 26-29 at the new laboratories of the Board's Coal Research Establishment at Stoke Orchard, near Cheltenham, Gloucestershire.

Professor Cyril S. Smith, Sc.D., of the University of Chicago, will deliver a lecture before the Institute of Metals on "The Beginnings of Metallography." The meeting will be held at 4 Grosvenor Gardens, London, S.W.1, on Wednesday, April 25, at 6.45 p.m. Visitors will be welcome. Tickets are not required.

Leaders of U.K. employers' organizations, trade unions and bodies concerned with human relations in industry attended a conference on Human Relations in Industry in Rome, at which more than 100 delegates from twelve nations will be present. The conference opened on January 29 and continued until February 4. It was sponsored by the European Productivity Agency of the O.E.E.C. and the Italian Productivity Centre.

Sion Tin (F.M.S.) Ltd. have removed to 22 Old Broad Street, London, E.C.2.

The London offices of Hickson's Timber Impregnation Co. (G.B.) Ltd., have been moved from Victoria Street to 8 Buckingham Palace Gardens, London, S.W.1, telephone: SLOane 0636. The new establishment will continue to house the export division of the company and is also the London office of all the companies of the Hickson group.

CONTRACTS AND TENDERS

Formosa.—TEN/17676, rock drilling equipment and materials. Closing date, 28/2/56. B.O.T. Ref.: ESB/2091/56/ICA. Telephone enquiries to Chancery 4411. Extension 360.

Formosa.—TEN/17684, air compressor. Closing date 29/2/56. B.O.T. Ref.: ESB/2096/56/ICA. Telephone enquiries to Chancery 4411. Extension 360.

Formosa.—TEN/17679, pneumatic sump pumps, rubber hose and couplings. Closing date, 28/2/56. B.O.T. Ref.: ESB/2092/56. Telephone enquiries to Chancery 4411. Extension 360.

Burma.—TEN/17730, diesel engine driven air compressors. Closing date, 14/2/56. B.O.T. Ref.: ESB/2622/56. Telephone enquiries to Chancery 4411. Extension 738 or 771.

Burma.—TEN/17852, centrifugal pumps. Closing date, 20/2/56. B.O.T. Ref.: ESB/3230/56. Telephone enquiries to Chancery 4411. Extension 738 or 771.

Formosa.—TEN/17673, blasting machines, miners' lamps and helmets. Closing date, 27/2/56. B.O.T. Ref.: ESB/1819/56/ICA.

The International Co-operation Administration recently announced the following authorisation:

Israel	Contract Period	Terminal Delivery Date	Amount (in U.S. dollars)
Equipment for Minerals Project (PIO/C No. 71-21-035-9-30164)	1/1/56	30/6/56	40,000
B.O.T. Ref.: ESB/2381/56/ICA. Telephone enquiries to Chancery 4411. Extension 360.	31/3/56		

The German Federal Office for Industrial Trade has announced that under Allocation No. 355376/02 platinum group metals, wastes and scrap may be purchased by recognized German importers from the U.K. and certain other countries to a value of 3,360,000 D.M. B.O.T. Ref.: CRE/654/56. Telephone enquiries to Trafalgar 8855. Extension 2171.

This information is supplied by the Special Register Information Service of the Board of Trade, Lacon House, Theobalds Road, London, W.C.1.

Henry Meadows, a subsidiary of Associated British Engineering and Automobile Products of India, have signed an agreement for British engines to be made under licence in India. The Indian company has ordered £1,000,000 worth of Meadows "330" automotive engines.

METALS, MINERALS AND ALLOYS

COPPER.—Copper remained extremely tight in the United States last week although the big producers are still able to hold their quotation of 43 c. per lb. Custom smelters are now quoting as much as 52 c. for February and March copper (over 52 for small parcels of prompt metal), April at 51 and May at 50 c. It is reported by *Reuter* that a package deal has been done in second quarter copper at 50 c. Consumer demand is still strong and the shortage is worsened by the continuing strike at Laurel Hill refinery. The loss of metal from this source is about 3,000 tons a week and it has now lasted more than four weeks. There are now rumours that the strike is nearer settlement than at any time, but it has followed such a curious course that it is difficult to feel confident. The strike was originally described as a wildcat and it is true that it had purely local causes; but it soon developed into a quarrel between the local and the international union of the United Steel Workers. What began as a dispute between workers and management is now one between different sections of the union. Meanwhile, the metal shortage has been made more serious by a power failure on the Gaspe Peninsula which has brought smelter operations to a halt. Finally, the pre-Christmas strike in Chile is now making itself felt through the interruption in supplies. A number of strikes in the brass-making and fabricating sections of the industry have tended to ease demand for metal, but they also point to the generally strike-happy conditions in the American copper industry.

An interesting development of the past few months has been the independent price quotations of the custom smelters. The custom smelters took leave of the big producers last year and have since maintained separate quotations. In the course of the last two and a half months their quotations for spot copper have ranged over a full 7 c. per lb. while the big producers have struck at 43 c. The custom smelters have indeed fairly sensitively recorded the shifts in sentiment caused by the Chilean strike, the end-year stocking process, the slight fall in business confidence, the renewal of strength and the Laurel Hill strike. What is more the quotation has been often in contrast to the trend on the London Metal Exchange which all along has been inclined to be more bearish than New York. It is a quotation open to the same objection as the L.M.E. price—it is made on a small volume of transactions. Nevertheless it is extremely valuable (even to the big producers) and is to be welcomed as a realistic assessment of the strength of current demand.

Mr. Prain has recently said in New York that there is only a "slender" chance of a uniform world price for copper. If this means there is no chance of a world acceptance of the E. & M.J. quotation (or a price calculated on its basis) that is much to be thankful for. But a series of reasonably free markets throughout the world would not be far out of line given reasonably free conditions of trade. On the same occasion Mr. Prain said that there would be no decline in world copper prices in the first half of this year but he declined to forecast after that time.

Reuter reports from Santiago that Caja de Credito Minero has sold 2,250 tonnes of electrolytic copper to West Germany at 50.11 c. and hopes to sell further quantities of this copper (produced by the Chilean mines) in Europe.

Austrian output of copper ore was 163,000 tons in 1955.

LEAD.—Lead has been an active market in New York on the basis of 16 c. per lb. and consumer buying has been brisk. In part, this firmness has reflected the continuance of the dock strike in Australia. The actual effects of this strike are, of course, difficult to assess. The mines have continued to work and the interruption can be judged only if it is known how much metal got away before the strike (it was believed to be substantial) and how soon after the strike is over the ships can get it moving again. The latest news is that the dockers have been urged to return to work by their leaders of the union movement—but not so far by the leaders of their own union—so as to allow the dispute to go to arbitration.

Meanwhile in the United States there have been interesting speeches on the future of the American lead industry. Mr. Andrew Fletcher, president of St. Joseph Lead, has again called for higher tariffs to protect the domestic industry. "The problem," he said, "is simply stated. Domestic miners are faced with steadily rising costs, the major elements of which are almost beyond their control. They cannot raise prices too high or they will encourage their competitors in other materials. They cannot sell as low as foreign producers can, because their lower grades of ore and higher wage scales make it impossible." That is a pretty fair statement of the Americans' dilemma. It is a pity that he brought in the point about the wage rates because they are not vastly different in certain countries where America buys lead—Canada and Australia—and the wage problem is

nothing like so acute anyway as the fact that the American ores are getting leaner. But Mr. Fletcher is far from fair when he says, "we admit that the adequacy of this supply depends to some extent at least on imports"; or again, "the domestic producer cannot completely satisfy the domestic market, except when domestic demand drops seriously". The dependence of the United States on foreign supplies is both heavy and permanent and it does not help the problem to attempt to understate the degree of that dependence. He wants a higher tariff but is prepared to allow that stockpiling might be satisfactory if it were guaranteed for "five or even ten years". But he himself later states that he dislikes the bartering of farm produce for minerals; would subsequent governments feel free to barter or sell lead stockpiled in excess of military needs? What Mr. Fletcher ignores is the constant threat to orderly expansion of mineral production outside the United States by these continuing calls for protection by the American producers.

Mr. Otto Herres, chairman of the National Lead and Zinc Committee, puts arguments for bigger tariffs also. He claims that the present policy is leading to a dangerous dependence on supplies outside America. He laments that the last rise in the price of zinc was designed not to help the American miner but to encourage imports. In part this was true but surely the American producer benefited from it? He then goes on to add that the stage has been reached when it is "necessary to raise the price of lead and zinc to protect the American consumer". But if Mr. Herres had had his way the American consumer would have paid 13.50 c. and more long since given the tariff increase he is demanding. These speeches are no doubt part of the election year campaign but it is time the Americans realized the harmful effects they are having on mining outside their shores.

TIN.—Tin fell for most of last week in New York going down to 99 c.; it then rose to 100.25 c. on the greater firmness in London and the news from Malaya. It may well be that the long downward fall has come to an end. All the statistical evidence shows that tin may well seem a bargain at its present price before mid-summer. But it was a long time before the market took much notice of the threat to supplies from Malaya and it has been much more taken with the fact that the International Tin Agreement may soon come into force. The news that Indonesia had passed the Bill ratifying the agreement was used to justify a further decline. (In fact ratification is not complete till the instrument is deposited in London.)

The common view is that the very existence of the I.T.A. must drag down the price. This view is based on the fact that at present prices producers will offer cash (at £640 a ton) rather than metal and that the I.T.A. buyer is precluded from buying till the price is down to £720. *Ergo* tin must drop to £720 a ton. There is no doubt that tin is in a state of considerable surplus and this inevitably means that the present price must come down; but it is also true that tin is—and will remain till mid-summer—in a state of market deficit for although there has been some falling off in commercial demand it comes nowhere near the amount still being removed by the American stockpile. Furthermore, there is no reason why the producers should not agree to put up metal (or an agreed percentage of it) rather than money. Such an agreement might be difficult to obtain but it is not impossible and it might well suit the producers even if—in the short run—it is rather more expensive. But the biggest doubt of all is the situation in Malaya. It has been pointed out in this column before that in both Malaya and Singapore the labour outlook is far from promising. Given the two facts of a rapid advance to self-government and primitive political organization, it is inevitable that political unrest will find industrial outlets. (What has also to be considered—in other countries beside Malaya—is the effect of restrictive schemes on labour relations. Will a need to cut output make management less fearful of strikes?)

At present Malaya is threatened by a strike in the tin mines. Two meetings already held have approved strike action and a general meeting of the Selangor division to the union is to be held on February 26. It is being recommended that members should take a day off to attend this meeting. Half the Malayan miners are in this division. A strike is also threatened by 65,000 government employees if their wage claim is not allowed to go to arbitration. A meeting is called for February 20.

ZINC.—Zinc has continued a steady market on the basis of 13.50 c. per lb. for prime western grade East St. Louis. Demand has picked up on earlier weeks partly because of the influence of the dock strike in Australia. Demand for special high grade zinc is still well below the peak of a month or two back but there is no sign of weakness in the metal as yet.

GERMANIUM.—A group of workers of the faculty of metallurgy at the Warsaw College of Science and Technology have devised a method of obtaining germanium and gallium on a semi-technical scale. It is reported that Poland will soon produce several kgs. of this scarce metal, which is being used to an increasing extent in transistors, rectifiers and other electronic devices.

QUICKSILVER.—One of the great metal mysteries of 1956 was provided by the large scale of U.S. Government purchases of quicksilver, presumably for stockpiling purposes, which absorbed some 47,000 flasks out of a net total availability of 89,000 flasks. There has been no recent evidence of large purchases of quicksilver by the U.S. Government, but the mystery has become even more baffling. The most plausible explanation at the time was that quicksilver was being absorbed by the atomic energy programme, possibly as a coolant or heat exchanger. It has been pointed out, however, that at the recent Atoms for Peace Conference in Geneva, there was no mention of mercury as being among the many metals, liquid metals and alloys playing important parts in the peaceful uses of atomic energy. Does this mean, asks *Mining World*, that mercury is a component in the military uses of the atom? Does it mean that at one time mercury appeared to have such important uses that it was necessary to corner the world's stocks? Or is the U.S. Government interested in mercury for guided missiles or some ultra-top secret weapon? Answers to these questions would be of considerable interest on both sides of the Atlantic. At present there is little buying of quicksilver in the U.S., where spot metal is now quoted at \$272-276 per flask, compared with the previous low of \$276.

SELENIUM.—The discovery of what is believed to be the world's largest deposit of primary selenium ore is reported from Baggs, Wyoming. This occurrence was found on a property belonging to the Shawano Development Corporation, which is being mined for uranium. Rotary drilling and chemical assays have resulted in ore samples running as high as 1.78 per cent and averaging 0.74 per cent. Ore running 0.08 per cent or higher is considered exploitable. Root and Simpson, of Denver, one of the four firms approved by the Atomic Energy Commission as assaying umpires, state that samples taken from this property assayed chemically as high as 35 lb. to the ton, on which basis the ore would be worth about \$700 per ton. According to Professor Paul H. Keating, Associate Professor of Geology at the Colorado School of Mines, this occurrence is believed to be the first primary or natural bedded deposit yet found. Selenium has hitherto been derived mainly as a by-product of blister product. In view of the present scarcity of this critically important material, further news of such a potentially large new source of supply will be awaited with the greatest interest.

TITANIUM.—Government officials in Washington consider that there is substantial evidence to support the view that titanium production in the U.S.S.R. may be greater than in the U.S., and may, in fact, be between 90,000 and 95,000 tons a year. This opinion is based on a reported production of 2,000,000 tons annually of ilmenite-magnetite ores from north-western Russia and the Urals, this being the indicated scale of production in 1951. Metallurgists estimate that approximately 360,000 tons of titanium could be produced from these ores, about 31.6 per cent being in the form of metal. Allowing for waste in processing the sponge, the Russian production could be about 95,000 tons. It is believed that the U.S.S.R. has the technical know-how to produce titanium metal of a quality at least equal to that of the U.S. product. The only factor likely to limit metal production to a figure lower than the U.S. output is lack of facilities to do the job. Evidence that the Russians are producing substantial amounts of titanium metal is afforded by the fact that titanium was found in liberal application in planes captured during the Korean war and in Russian machinery that has found its way outside the Iron Curtain. It is believed that an increase in plant and equipment for producing the metal will be an important part of the sixth five-year plan.

The London Metal Market

(From Our Metal Exchange Correspondent)

The copper market is still dominated by the shortage of nearby metal, but it appears as if it will require a real buying wave to raise the cash quotation much in excess of £400 per ton. On some days there has been a fair demand for three months' metal and then the backwordation has tended to narrow through a rise in the forward quotation, but it is felt that any news which will affect sentiment adversely will lead to appreciably lower quotations in a very short time. The behaviour of the market has once more demonstrated the close link between it and all that copper in the world which is not subject to price-

fixing by producers, and it is still to be hoped that the day will come when a very much larger tonnage of metal will be available to free-trading in the world with the beneficial result that a single copper price will come more into the realms of possibility, as it must not be overlooked that the bigger the tonnage involved in the fixing of the free price the less violent will be the fluctuations.

The tin market receded inexplicably over the week-end as the present supply position is by no means easy, and with the likelihood of disturbances in Malaya it is expected that consumption and intake into the stockpile up till the end of June will probably exceed production, and, although the market normally foreshadows coming events, it is a little early for the expected surplus during the second half of the year to be an influence at present. On Wednesday morning the Eastern price was equivalent to £776 per ton c.i.f. Europe.

The lead and zinc markets have been little affected by fluctuating rumours on the progress towards a settlement of the Australian dock strike, and with the continued intake into the American stockpile of monthly tonnages the easier tendency in lead is difficult to understand.

Closing prices and turnovers are given in the following table:—

	February 1		February 8	
	Buyers	Sellers	Buyers	Sellers
Copper				
Cash	£398	£399	£398½	£399
Three months	£381	£382	£379	£380
Settlement		£399		£399
Week's turnover	3,025 tons		4,050 tons	
Tin				
Cash	£786	£788	£786	£788
Three months	£772	£773	£767	£768
Settlement		£788		£788
Week's turnover	715 tons		775 tons	
Lead				
Current half month	£117	£117½	£115½	£115½
Three months	£114½	£114½	£112	£112½
Week's turnover	6,100 tons		5,275 tons	
Zinc				
Current half month	£99½	£100	£98½	£98½
Three months	£95½	£96½	£94½	£95
Week's turnover	3,675 tons		4,625 tons	

OTHER LONDON PRICES—FEBRUARY 9

METALS

Aluminium, 99.5%, £179 per ton	Nickel, 99.5% (home trade) £519 per ton
Antimony—	Osmium, £24/27 oz. nom.
English (99%) delivered, 10 cwt. and over £210 per ton	Osmiridium, nom.
Crude (70%) £200 per ton	Palladium, £8 0s./£8 10s. o.m.
Ore (60% basis) 23s. 6d./24s. 6d. nom. per unit, c.i.f.	Platinum U.K. and Empire Refined £32 10s. oz. Imported £39 0s./£41 0s. oz.
Bismuth (min. 1 ton lots) 16s. lb. nom.	Rhodium, £40/£42.
Cadmium 12s. 0d. lb.	Ruthenium, £16/£18 oz.
Chromium, 6s. 11d./7s. 4d. lb.	Quicksilver, £87 10s. ex-warehouse
Cobalt, 21s. lb.	Selenium, 72s. nom. per lb.
Gold, 249s. 3½d.*	Silver, 78½d. f.o.z. spot and 77½d. f.d.*
Iridium, £29/31 oz.	Tellurium, 15s./16s. lb.
Manganese Metal (96%-98%) £269 according to quantity	
Magnesium, 2s. 4d. lb.	

ORES, ALLOYS, ETC.

Bismuth	65% 8s. 6d. c.i.f.
Chrome Ore—	18%/20% 1s. 3d. lb. c.i.f.
Rhodesian Metallurgical (semi-friable) 48%	£15 2s. 6d. per ton c.i.f.
Refractory 45%	£14 2s. 6d. per ton c.i.f.
Smalls 42%	£12 2s. 6d. per ton c.i.f.
Magnesite, ground calcined	£27 10s./£28 10s. d/d
Magnesite, Raw	£11 10s./£12 10s. d/d
Molybdenite (85% basis)	8s. 2½d. nom. per lb. c.i.f.
Wolfram and Scheelite (65%)	260s. 0d./265s. 0d. c.i.f.
Tungsten Metal Powder (98% Min. W.)	20s. 10d. nom. per lb. (home)
Ferro-tungsten (80%-85%)	17s. 10d. nom. per lb. (home)
Carbide, 4-cwt. lots	£39 3s. 9d. d/d per ton
Ferro-manganese, home	£59 10s. 0d. per ton
Manganese Ore Indian c.i.f.	
Europe (92%-97%) basis 110s. freight	90d./95d. per unit c.i.f.
Manganese Ore (82%-87%)	80d./85d. per unit c.i.f.
Manganese Ore (67%-70%)	65d./68d. per unit
Brass Wire	3s. 7½d. per lb. basis
Brass Tubes, solid drawn	3s. 0½d. per lb. basis

* Price on February 8.

COMPANY NEWS AND VIEWS

Gold Recovery

It was "all golds" in London this week. Activity in South African mining issues touched highest levels for many months, markings actually rising on Wednesday to over one thousand. Little shop buying was evident and it therefore seemed that investors fearing industrial recession in the U.K. were being attracted towards gold shares. Elsewhere sentiment remained under the cloud of uncertainty surrounding Mr. Macmillan's intentions in the campaign against inflation. Wall Street could not shake off its political doubts and by Wednesday the Dow Jones Industrial Index had receded about seven points to 471.23. The *Financial Times* Industrial Index shed a further two points to 185.7.

Kaffirs improved right through the list hoisting the Gold Share Index to 90.4. Some initial London profit taking was quickly absorbed by strong support from the Cape and prices opened firm on Thursday morning. With crucial constitutional problems coming up for consideration in South Africa next week this was taken as an extremely good show of confidence. Although many established producers made useful gains, most attention was focused on O.F.S. issues. Free State Geduld quickly reasserted its position advancing from about £3. 21/32 to just over £4. Welkom put on about 2s. 6d. to 20s. 9d. St. Helena moved up from 26s. 3d. to a shade over 29s.; President Brand from £2. 31/32 to £3 and Loraine from 5s. 9d. to 7s. Amongst Far Western Rand issues Doornfontein was a good spot, rising from 21s. 6d. to 25s. Blyvoor jumped 2s. to 25s.

Amongst West Africans, Western Selection received some support and advanced 1s. to 8s. 9d. Other mines in this section made some good gains.

On the whole, Malayan Tins were dull and little enthusiasm was initially shown in the news that Malaya was to stay in the sterling area on gaining independence in 1957. Amongst coppers R.S.T. finished at 47s. 6d., losing the rise which followed excellent six-monthly figures. Roan remained unchanged at 27s. 3d. Rio Tinto fell £½ to £3½ on the rights issue announcement.

Copper Profits Boom

Due principally to cutbacks in both the U.S.A. and the U.K. motor industries a somewhat cautious atmosphere has surrounded copper metal and share prices since the end of 1955. Reflecting this, the *Financial Times* weekly share price index for copper has receded from 416.9 to 399.4 since January 1. It is comforting, therefore, to be reminded that profits earned by Copperbelt producers, in particular Mufulira and Roan Antelope, continue to expand.

Indeed, if Mr. R. L. Prain's view is accepted they should continue to do so at least for the next six months. Speaking recently at the informal meeting held in New York, Mr. Prain—who is chairman of the R.S.T. group—expressed his opinion that copper prices should continue firm, at any rate until the summer. As both Mufulira and Roan Antelope's financial years end on June 30, 1956, he can, with confidence, look for greatly increased profits from both companies.

With its present fixed price for copper of £360 per ton as

	Mar. Qtr. 1955	June Qtr. 1955	Sept. Qtr. 1955	Dec. Qtr. 1955
Mufulira				
Sales	18,646	25,022	23,135	22,568
	(£000)	(£000)	(£000)	(£000)
Revenue	5,843	7,227	7,193	7,886
Costs	2,121	4,630	3,464	3,833
Difference in value of copper stocks	Dr. 478	Cr. 463	Cr. 200	Cr. 434
Surplus	3,244	3,060	3,929	4,487
Replacements*	196	201	264	239
Profit before taxation†	3,048	2,859	3,665	4,248
Roan Antelope				
Sales	19,872	23,988	18,945	21,162
	(£000)	(£000)	(£000)	(£000)
Revenue	6,055	6,895	5,796	7,278
Costs	2,253	4,727	3,562	3,719
Difference in value of copper stocks	Dr. 549	Cr. 467	Cr. 893	Cr. 279
Surplus	3,253	2,635	3,127	3,838
Replacements*	185	152	147	126
Profit before taxation†	3,068	2,483	2,980	3,712

* Subject to revision when year's accounts considered.

† Estimated.

compared with about £397 on the London Metal Exchange, the R.S.T. group provides a useful preview of conditions which might generally prevail if a drop of, say £35 per ton, did in fact take place. Indeed, with costs during the current quarter somewhere in the region of £156 per ton from Mufulira and £168 a ton for Roan (compared with about £133 and £142 respectively during their financial years ended June 30, 1955), profit margins before tax would appear to be £200 per ton or 125 per cent. By any mining standards this is most satisfactory, and provides a good deal of margin to cope with further rises in expenses. Costs on the Copperbelt are, of course, greatly enhanced by

RAND AND O.F.S. RETURNS FOR JANUARY

Company	January, 1956			Year ends	Current Financial Year			Last Financial Year	Total to date	Profit
	Tons (000)	Yield (oz.)	Profit (£000)		Tons (000)	Yield (oz.)	Profit (£000)			
Goldfields										
Doornfontein	54	21,748	81.7	J	360	144,837	580.1	350	118,149	589.4
Liberton	97	21,345	75.0	J	680	148,438	403.3	681	143,041	364.6
Lupatards V.	119	15,668	67.2	J	870	126,493	428.6	771	150,116	303.4
Rietfontein	26	5,956	18.6	D	26	5,956	18.6	27	6,024	20.6
Robinson	78	17,347	12.4	d	78	17,347	12.4	97	20,176	30.9
Simmer	100	17,877	13.1	d	100	17,877	13.1	120	20,042	19.8
Sub Nigel	66	20,326	70.3	J	465	146,375	546.6	464	153,021	662.6
Venterspost	117	28,279	70.2	J	848	200,378	534.9	738	182,376	439.6
Voorfontein	39	14,400	70.2	J	39	14,400	70.2	39	14,274	74.7
Vogels	103	26,266	6125.2	D	103	26,266	125.2	103	26,654	113.5
West Drie	71	55,540	430.6	J	426	329,849	2605.1	319	242,147	1872.4
Anglo										
American										
Brakpan	109	18,585	16.6	D	109	18,585	16.6	109	18,369	16.0
Daggas	200	45,801	259.4	D	200	45,801	259.4	221	50,388	311.6
East Daggas	94	15,558	35.5	D	94	15,558	35.5	94	15,779	48.0
P. Brand	52	41,683	345.3	S	207	165,773	1373.1	J	—	—
P. Steyn	84	30,433	169.6	S	331	119,393	659.5	J	—	—
S.A. Lands	84	16,675	47.3	D	84	16,675	47.3	97	18,031	56.8
Springs	124	15,314	14.0	D	124	15,314	14.0	117	16,154	8.0
Welkom	80	17,181	19.8	S	325	67,622	69.9	J	—	—
W. Holdings	74	28,550	168.5	S	295	112,542	667.1	J	—	—
W. Reef Ex.	112	22,388	48.6	D	112	22,388	48.6	118	22,043	56.0
Central										
Mining										
Blyvoor	102	58,089	410.6	J	730	414,221	3033.4	723	417,465	3204.0
City Deep	153	29,271	3.1	D	153	29,271	3.1	166	30,693	8.5
Cons. M.R.	162	23,300	13.3	J	1,196	170,055	129.9	1,227	176,931	201.5
Crown	285	45,722	40.3	D	285	45,722	40.3	293	47,168	50.0
D. R'poort	181	30,032	53.5	D	181	30,032	53.5	178	29,589	50.7
E. Rand P'p	202	32,521	174.9	S	202	32,521	174.9	212	49,012	145.1
Harmony	77	36,187	151.2	J	700	187,304	953.1	211	75,315	223.7
Modder B.	52	5,377	0.4	D	52	5,377	0.4	54	5,523	1.1
Modder East	131	13,559	6.5	J	902	95,821	52.9	857	96,219	105.6
Rose Deep	46	7,511	3.5	D	46	7,511	3.5	62	9,917	9.5
Welgedacht	34	3,957	0.4	J	237	27,037	3.0	234	27,307	11.0
J.C.I.*										
E. Champ	17	1,050	e6.3	D	17	1,050	16.3	19	1,588	5.5
Freddies C.	74	11,860	L50.0	D	74	11,860	L50.0	92	13,184	L45.8
Govt. G.M.	230	29,417	d18.7	D	230	29,417	18.7	260	34,161	39.1
Randfontein	263	25,221	e100.5	D	263	25,221	100.5	256	30,569	85.0
Union										
East Geduld	131	41,538	294.1	D	131	41,538	294.1	146	44,900	338.4
Geduld	104	16,535	38.1	D	104	16,535	38.1	98	16,583	45.2
Grosvlei	190	41,127	227.0	D	190	41,127	227.0	185	39,774	223.7
Marivaale	70	18,305	84.3	D	70	18,305	84.3	72	18,325	87.5
St. Helena	98	28,424	151.2	D	98	28,424	151.2	102	24,581	103.6
Van Dyk	80	13,090	1.2	D	80	13,090	1.2	79	13,165	1.6
General										
Ellioton	31	7,542	a27.6	D	31	7,542	27.6	30	9,633	52.8
S. Roodep't.	27	6,342	22.2	J	193	43,974	156.4	192	41,714	142.2
Stilfontein	83	32,626	a194.3	D	83	32,626	194.3	82	32,383	208.3
W. Rand C.	230	23,115	d234.1	D	230	23,115	234.1	235	27,249	225.0
Transvaal										
Hartebeest'n	53	24,778	133.7	J	351	150,297	719.6	—	—	—
N. Klerksd'p	10	1,189	g7.0	D	10	1,189	7.0	11	1,417	L1.0
Rand Leases	163	26,325	12.3	J	1,239	197,994	181.9	1,287	215,144	313.3
Village M.R.	33	4,996	9.0	J	239	35,346	66.2	241	36,209	71.6
Virginia	75	16,200	109.1	J	491	104,728	585.6	208	38,661	35.9
Others										
Nigel Gold	30	3,687	Nil	D	30	3,687	Nil	24	3,595	3.7
N. Kleinf'p	105	12,251	3.5	D	105	12,251	3.5	108	12,904	5.0
Sparwater	10	3,047	0.8	D	10	3,047	0.8	10	2,825	1.2
W. Nigel	18	3,994	6.7	J	128	26,865	56.2	123	27,661	68.5

* Working Profit figures includes Sundry Revenue.

† Working Profit.

‡ Gold and Uranium.

L indicates loss.

a including gold and uranium profit £56,000, from Bird Reef, subject to adjustment and before provision of quarterly loan instalment of £77,100.

b including £48,000 uranium profit — before quarterly loan and instalment repayments of £72,000.

c after crediting £45,000 estimated uranium revenue.

d after crediting £13,601 estimated revenue from pyrite.

e after crediting £335,000 estimated net revenue from uranium and acid.

f after crediting £319,000 estimated profit from uranium.

g after crediting £12,000 profit from uranium, before loan repayment of £750.

h excluding uranium profit which is declared quarterly.

i after crediting £90,766 from acid and uranium; no plant repayment due.

j Financial year end changed to September, therefore last year's figures not comparable.

royalty and mineral payments which, together with cash bonuses and life assurance schemes, totalled about £45 per ton produced during the financial years ended June 30, 1955. Price fluctuations on the metal are thus cushioned to some degree—either way—by these liabilities which are, broadly speaking, geared percentage-wise to copper prices.

Looking specifically at the prospects for Mufulira and Roan during their current financial years, it would seem that if production is not seriously interrupted by strikes or lack of fuel and copper prices—as Mr. Prain anticipates—remain steady, profits should show sharp advances over the previous year's level. In 1954-55 Mufulira's output was 83,193 l.tons of copper while that of Roan was 82,696 l.tons. Figures for the six months ended December 31, 1955, revealed that Mufulira had produced 48,358 l.tons and Roan 43,636 l.tons. Yearly rates of about 96,500 l.tons and 87,000 l.tons respectively are thereby indicated.

Whether these gains in output will actually eventuate or not is anyone's guess. But current figures based on a profit margin of only £150 per ton of copper produced (instead of the current £200) or £90 after Rhodesian tax would certainly provide scope for higher dividends in respect of the years ending June 30, 1956. Assuming that all copper produced is sold, Mufulira—after replacements provision of £1,500,000—could earn some £7,100,000 as against £6,400,000 after tax but before reserves during 1954-55. In the case of Roan a figure of some £6,800,000—after allowing £1,000,000 for replacements—as against £5,900,000 would seem possible.

In anticipation of these greater earnings Rhodesian Selection Trust (which owns virtually 64 per cent of Mufulira) return at

their present price of about 47s. 6d. just over six per cent before allowing for double taxation relief. Because of its more limited life potential, Roan Antelope at a price of 27s. 3d. yield nine per cent. Since the beginning of 1955 R.S.T. shares have been as high as 58s. while Roan have touched 30s.

This may not be the best time to buy copper shares—indeed it seems possible that prices might move lower before recovering. But the metal's strong statistical position undoubtedly holds great promise in the long term. During the next few weeks, therefore, it will be worth while watching both R.S.T. and Roan. While the two issues have their own particular attractions, R.S.T. is the one with growth possibilities. Eventually its Baluba and Chambishi Properties will be exploited. On reaching this stage these shares, if still standing at anything like their present level, could look ridiculously undervalued.

RECENT INTERIM DIVIDEND ANNOUNCEMENTS

Company	Year ending	Dividends %	Date payable	This year to date %	Total last year %
Geevor Tin	31.3.56	15	Feb. 28	15	45
Kamunting Tin	31.3.56	7½	Mar. 7	7½	20
Kent F.M.S.	31.12.55	10(a)	Feb. 22	20	40
Pengkalen	30.9.56	10	Feb. 7	10	35
Int. Nickel	21.12.56	\$0.65(b)	Mar. 20	\$1.30(b)	\$3.75(b)
Zaaiplaats Tin	31.12.56	25	Mar. 10	25	40

(a) 2nd interim (1954-5) interim 10 per cent. 2 interims 15 per cent.)

(b) U.S. currency (1955 - First two quarterly dividends \$0.55; second two \$0.65; and \$1.35 year end extra payment).

THE SOUTH WEST AFRICA COMPANY

APPLICATION FOR CHANGE OF DOMICILE REFUSED

MR. J. E. W. LOMAS ON GOVERNMENT'S DECISION

The Annual General Meeting of The South West Africa Company Limited was held on February 8, in London.

In his Statement which was circulated to Shareholders with the Report and Accounts, Mr. J. E. W. Lomas, the Chairman, after reviewing the Accounts, said:—

Members have been advised that Her Majesty's Treasury have rejected the Company's application to move its seat of control and management from the United Kingdom to South West Africa, where its mining operations are conducted. We were not given the reasons for this refusal, and we therefore sought a further interview with the Advisory Panel to the Treasury. The reply received was to the effect that no purpose could be served by such an interview unless we had further material facts or evidence to lay before the Panel. We were not told the point towards which such evidence should be directed.

Our application in general was based upon the urgent desirability of our Board of Directors being centred in South West Africa and the Members thereof being well known to and in close personal touch with the Government of the Territory in which we operate. We gave, as we thought, considerable evidence in support of this contention. It would appear, however, that it was not enough.

But are we not entitled to believe that no evidence on this point should have been necessary at all, for it is a matter of common knowledge that the Governments of all Territories increasingly tend to resent the slight on their dignity and self-respect which is implied by their being approached indirectly by Boards sitting in distant lands through local Agents or Representatives.

GOVERNMENT POLICY IN MALAYA

In this connection, I have lately been reading the Address of His Excellency the High Commissioner in Malaya at the opening of the Budget Meeting of the Federal Council on November 30, 1955. After summarizing the advantages which overseas capital had enjoyed in its investment in Malaya, he went on to enumerate what, in his view, Companies should now do in return. One of the principal points he stressed was that Companies should "transfer to Malaya wherever possible the effective seat of direction of undertakings whose sole or principal seat of activity is in this country." It must be assumed that the High Commissioner was precisely expressing the views of Her Majesty's Government. It would seem inevitably to follow from this statement of policy and from the action taken by Her Majesty's Treasury in regard to the Northern Rhodesian Copper Companies, that Treasury consent to a change of residence is given where the demand for the recognition of national prestige and self-respect is sufficiently insistent and vocal.

In our case it is the expressed desire of the South West African Administration that we should have our central control and management in South West Africa. The Treasury is aware of this fact.

If the Treasury's refusal to permit our change of residence is maintained, I fear that severe damage may be sustained by our Company.

H.M. TREASURY'S BARREN AND FRUSTRATING REPLY

As a matter of courtesy a copy of the six foregoing paragraphs of this statement was sent to Her Majesty's Treasury under cover of a letter dated December 15. In this letter I also referred to certain aspects of our interview with the Advisory Panel which seemed to us inadequate and unsatisfactory. Comment on these matters was respectfully invited. The reply dated December 23 was completely barren and frustrating. It read:—

"In reply to your letter of December 15, I am to refer you to the Chancellor of the Exchequer's 'remit' to the Advisory Committee in August 1951, a copy of which is enclosed for your information.

"I am to add that the Committee have no comment to offer on your proposed statement to shareholders at the Annual General Meeting of the Company."

I have been connected with a number of Companies where similar applications have been made and granted. In my personal opinion none of these applications was so firmly founded as ours. We will therefore continue to seek a review of the Treasury's decision in our case. Alternatively, perhaps we can hope for the early enactment of the recommendations in this respect made by the Royal Commission on the Taxation of Profits which would effectively set us free to do what we earnestly believe to be not only in the best interests of our Company but also of this Country. We produce certain vital imports from sterling sources which at present are not otherwise available in sufficient quantity except against dollar payments. Failing closer relations with the Government of the Territory in which we operate we might find difficulties in the way of our continued exploration, upon which the future of our Company as a substantial producer of Vanadium will depend.

In seconding the motion for the adoption of the Report and Accounts the Managing Director, Mr. L. G. Ray, gave the Meeting an up-to-date review of the Company's present and projected mining operations in South West Africa generally, with particular reference to the Abenab West Mine and the Tin/Tungsten property at Brandberg West.

The Report and Accounts were adopted.

SURVEYOR required for Gold Mine in South America. Graduate mining engineer preferred. Must be well experienced in Mine Surveying and Sampling. Knowledge of Spanish an advantage. Salary £107 per month (plus additional two months pay per year in local currency at the official exchange rate), for two years contract. Free furnished quarters, etc. Write giving full details to Box V263, c/o Streets, 110 Old Broad Street, E.C.2.

MINING GEOLOGIST (experienced) for gold mining Company operating in South America. Knowledge of Spanish an advantage but not essential. Salary £175 per month, plus additional two months' pay per year (in local currency at the official exchange rate) for two years contract. Passage self and wife defrayed by Company. Free furnished quarters, etc. Write, giving age and full particulars, training and previous appointments to Box. V. 209, c/o Streets, 110 Old Broad Street, E.C.2.

METALLURGIST possessing University Degree and some practical experience required for metallurgical test work in a Gold Milling Plant which includes Base Metal Flotation. Property situated in South America. Salary £107 per month, plus additional two months' pay per year (in local currency at the official exchange rate) for two years' contract. Passage self and wife defrayed by Company. Free furnished quarters, etc. Write, giving age and full particulars, training and previous appointments to Box V.236, c/o Streets, 110 Old Broad Street, E.C.2.

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Applicants should be honours graduates in engineering, preferably with mining experience; academic or research experience will be an advantage but is not essential.

Applications should reach the Professor of Mining, Royal School of Mines, Imperial College, London, S.W.7, before April 30, and further particulars may be obtained from him.

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Candidates, who should be between 23-35 years of age must have a University degree recognised as exempting from the Final Parts I and II of the A.M.I.C.E. examination or be graduates of the Institute of Civil Engineers or of the Institution of Mining and Metallurgy. They should also have at least two years post graduate professional experience preferably in the geological, hydrological, or geophysical fields.

Further particulars on written application to the Director of Recruitment, Colonial Office, Sanctuary Buildings, Great Smith Street, London, S.W.1. Please give brief details of age, qualifications and experience and quote reference BCD/107/7/09/H1.

MINE SUPERINTENDENT required for Company operating Lode Mines in South America and producing 12,000 tons per month of Gold/Silver ore. Only well experienced graduate mining engineers with knowledge of Spanish and Latin-American conditions should apply. Salary £3,500 per annum (plus additional two months pay per year, in local currency at the official exchange rate), for two years contract. Passage self and wife defrayed by Company. Free furnished quarters, etc. Write giving age and full particulars, training and previous appointments to Box V262, c/o Streets, 110 Old Broad Street, E.C.2.

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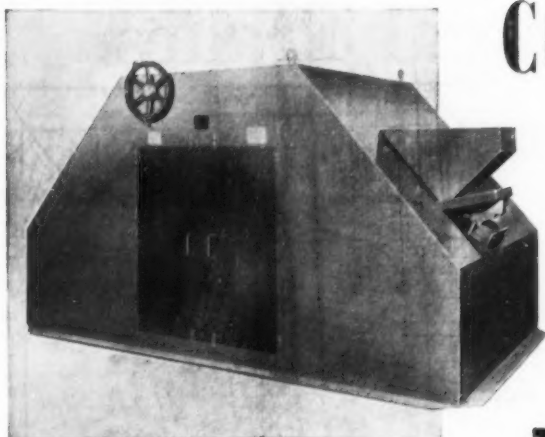


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